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TROPICAL DISEASES BULLETIN.

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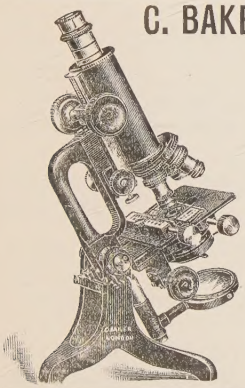

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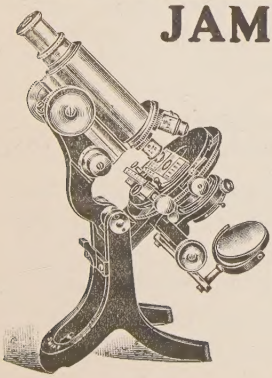

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January 24th, 1913.—Chemical, Biological and Clinical Study of GALYL, by Drs. DE BEURMANN (St. Louis Hospital) and TANON (communicated to the Société des Hopitaux de Paris).

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The Intramuscular Injections of GALYL, by Dr. BALZER.

MEDICAL ANNUAL (1914).—Syphilis.

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

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APPLIED HYGIENE IN THE TROPICS.

By Colonel W. G. King, C.I.E., I.M.S. (Retired).

REPORTS.

Applied Hygiene in East Africa.

The East Africa Protectorate has made notable advances in commercial prosperity. Communications have been vastly improved and commerce has followed ; but a stage has been reached where hygiene, the ally of commerce and national prosperity, cannot be safely ignored. Hence, instead of prescribing a scheme for a water supply here or a sewerage scheme there, after cholera or typhoid have harried a locality, the Colonial Office determined in 1913 to depute Professor W. J. Simpson, C.M.G., to East Africa, for a period sufficient for him to inspect and advise generally on the whole sanitary future of that area. The result is embodied in a characteristically complete and carefully considered Report that will repay perusal by all interested in Applied Hygiene in the Tropics.*

The rare opportunity of advising a policy for the future sanitary treatment of an area as large as France has been so dealt with by Professor Simpson that the true position of sanitation in the administration of a country has been kept fully in the forefront, by appeal to the common sense doctrine that, without health, the accumulation of wealth is for a people, as for the individual, a hopeless task ; yet, this appeal is not made without cognizance of the truth that, whilst health is " within human limitations purchasable," to secure the wherewithal for the purchase, sanitation can no more reasonably demand funds that may cripple commerce than that, by untimely demands or restrictions, commerce should cripple sanitation. He summarises the problems he found it necessary to attack in the economic interests of the country by declaring : " It cannot be emphasised too strongly or too frequently that a healthy native population is the chief asset of East Africa." He continues :—

" The conditions existing in this Protectorate . . . . which foster disease and favour its spread are special and urgent. These conditions are :—

" 1. Endemic plague in Kisumu and its district, in Nairobi and its environs, in the Ndara and Sagalla Hills, and the Taveta district.

" 2. Prevalence of smallpox and cerebro-spinal fever.

* Report on Sanitary Matters in the East Africa Protectorate, Uganda, and Zanzibar. (Printed for use of the Colonial Office.) Colonial Office: February, 1915.

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"3. The epidemic of sleeping sickness, although it has declined, in the absence of watchfulness may still be a source of danger to trade.

"4. Immigration from infected countries of Asiatics whose habits, customs, and secretiveness are such as to require a watchful control over the diseases they spread, and the intimate connection which the various races in the population maintain with their friends and relations in infected countries and localities.

"5. The greater liability of the natives to epidemic disease, owing to greater intercommunication with increasing commerce; the movements of natives in connection with labour supply, and the unhealthy conditions under which they work, which need medical inspection, control, and enforcement of sanitary measures.

"6. The insanitary conditions existing and constantly arising in towns and trade centres with a mixed population of Asiatics and primitive Africans."

To meet the conditions thus stated, there is first an interesting history of the mode of spread of epidemic diseases, which must prove of standard value to epidemiologists, and deductions are then drawn as to points of danger on new routes of commerce. From this the reader passes to a consideration of localities, and thus to the sanitary, legal and financial necessities of each case. Finally, attention is drawn to the absolute need, if success is to attend efforts on the lines advised, for the early calling into being of a technically trained sanitary organisation complete in both superior and subordinate grades, which shall deal with not merely a few of the chief localities of the country but be reasonably proportioned to both urban and rural areas. In treating this part of the subject, Professor Simpson definitely states the necessity (when the problems of any but petty administrations are considered) of maintaining a "distinct cleavage between curative and preventive medicine by appointing special sanitary staffs, and the only exception to this should be in out of the way districts where sanitary and medical duties may be combined, and where the new arrangement would dovetail into those already existing." Methods of routine sanitation and for meeting epidemic diseases—amongst which the necessity of control over cotton importation from plague-infected areas is particularly emphasised—town planning and the necessary legal measures for control of land before the bulk passes into the hands of speculators, are very thoroughly gone into, and the whole is well illustrated by maps. He insists strongly on a definite policy, as essential in the sanitary and social interests of native, Asiatic and European races, of separate zones in towns being established as the starting point of site plans.

Queensland*.

Dr. J. T. Moore opens his Annual Report for 1913 by the very necessary reminder that Queensland, whilst it deals with a white population, has to meet conditions that are largely tropical. He thus defines the position of Queensland in the epidemiological problems it has to face:—

"From an epidemiological standpoint the geographical situation of Queensland between 9 and 29 degrees south, and 138 and 153 degrees east longitude, must be regarded as one of much importance, especially when considering its vast area of 670,500 square miles, with a sea border of about 3,000 miles, containing many important commercial ports."

*Annual Report of the Commissioner of Public Health.

He then proceeds to show how the geographical position affords special reasons for sanitary care in respect to communication with Hongkong, where plague is endemic, with Manila, where cholera periodically occurs, with Java and Timor where smallpox is endemic, with New Guinea, whence "carriers" may bring with them malignant malaria, cholera, and dysentery, and (*via* the Panama Canal) with Costa Rica and Guayaquil—the haunts of yellow fever, Whilst showing that the organisation with which he has met these difficulties must be increased and improved, in accordance with the ever advancing dictates of hygiene, he is able to claim that his staff has worked with enthusiasm and effectively.

The birth-rate was 20·26 and the death-rate 10·39 per mille, in an estimated population of 652,555. He declares that Queensland has one of the lowest death-rates in the world, and in support supplies not only statistics of other countries but, what really is a better basis of comparison of local health conditions, namely, the infantile death-rate per mille of births. This, he shows, amounts to only 63·2 per mille.

Notification of communicable diseases is required by legal enactments. During the year cases of typhoid, scarlet and puerperal fevers, diphtheria, erysipelas, phthisis, ankylostomiasis, infantile paralysis, cerebro-spinal meningitis and chicken pox were notified. But the well-known difficulty in all parts of the world in securing timely action by local authorities, is not absent in Queensland. Dr. Moore states :—

"Unfortunately, through lack of foresight, coupled with a desire of false economy, many Local Authorities fail to secure the services of a Medical Officer of Health or a Sanitary Inspector, with the result that the utility of the notification system becomes futile and outbreaks of disease occur, and not infrequently become endemic, before the local governing body can be compelled to recognise its obligations."

Smallpox has been hitherto largely a negligible quantity in Australia, but it has recently been found necessary to consider the urgency of suppressing threatened epidemics. He shows that during the year a passport system was enforced. "The main gates of entry into the State were closely guarded by stationing officers at the border as well as by keeping a close surveillance over traffic arriving by sea, passengers being compelled to produce vaccination certificates, and to report at a central depôt at fixed periods."

Dr. Moore does not stay to discuss theories of fading virulence of smallpox nor of vaccination being regarded as a fetish of the past, but declares whole-heartedly his conviction of the importance of vaccination as the first line of defence ; he states :—"It is needless to quote the arguments in favour of or against vaccination, beyond saying that it cannot be too strongly emphasised that this prophylaxis is the only reliable preventive that can be employed against future invasions of smallpox."

Equally in respect to typhoid, he presses the advantage of anti-typhoid inoculation.

As to diphtheria he records that children lately affected, or in whose family a case has occurred, are excluded from school, till three swabbings of the throat bacteriologically examined prove them free of infection.

The following quotations from the Report show that in Queensland the vast importance of Applied Hygiene in the economics of a country is not forgotten, and that, personally, Dr. J. T. Moore rightly regards the great rôle of the sanitarian to be not the fussy work which appeals to the eye of the public when he attempts to suppress epidemics he has failed to stay, but the watchfulness and organisation which, through years of sustained effort, prevent them :—

"In the rank of a nation's importance the health of a country stands foremost. On it depends the welfare and material prosperity of its people—in fine, it is the existence of a nation. The special feature of the work performed during the past year has been an untiring and ceaseless endeavour to protect the State from a visitation of an epidemic, and it is with pleasure that I am able to record that the success attained in this respect has far exceeded expectations. . . . . Finally a good foundation is necessary for the construction of a good building, so also is good executive administration necessary for the successful organisation of a public health department."

DISEASE PREVENTION.

Malaria.

The Placenta and Malaria.

A research that must prove of practical importance is at present being conducted by the Board of Health Laboratory, Panama Public Health Department. In October, 1914, it was stated :—" The examinations of blood smears from the placenta and peripheral blood have disclosed several instances of placental segregation of parasites when they were practically absent from the peripheral blood." Evidently this research proved of interest, as by November it was announced that the scope of the enquiry was extended, so as to cover " the incidence of malignant and benign neoplasms among the white, mestizo and negro employees."

It seems to the writer that the action of the placenta in plague, as part of the problem of when and how fluctuation in numbers of the *B. pestis* in the peripheral circulation occurs, is also a matter that well merits attention by laboratory experts. References to results in the puerperal condition in this disease are exceedingly rare. Yet, in that part of the fight against plague which connotes prevention of introduction into a locality of the disease, as against suppression of epidemics, the position of the pregnant woman is of importance. As a matter of convenience—not of pathological significance—the term " puerperal plague " is in use. Fever without buboes followed by rapid abortion and death of both mother and child is the usual result. It is therefore, in practice, extremely likely to be overlooked just at the origin of an epidemic, when septicaemic plague exhibits itself by sudden death in old persons and pneumonia in the young. Irrespective of possibilities of inoculation by cuts or abrasions amongst the attendants of such cases in contact with blood discharged, the question of disposal of the placenta in respect to " soft feeding " by rats can hardly be ignored. The proportion of constantly pregnant women in an average healthy population is always considerable, and methods of disposal of the placenta differ largely with races. In Major Fry's " First Report on Bengal Malaria," he quotes the evidence of Babu Bagala Mukerjee before the Burdwan Commission of 1873 :— " The placenta which is discharged during the birth of a child is kept deposited in the room for five days, after which it is removed."

The importance of this question is emphasized by the following extract from the U.S.A. Public Health Report for 1914 (p. 239) :

" A series of experiments has been conducted for the purpose of determining, if possible, why plague is not present among ground squirrels until after approximately the 1st of April each year, which is the season of the year when the young squirrels are born. These experiments tend to show that active plague develops as a result of pregnancy in squirrels affected with chronic abscesses of lymphatic glands, liver or spleen. It is possible also that the young are infected with plague, either in embryo or immediately after birth, where the mother squirrel has plague. Further work is needed along this line for definite confirmation."

Larvicides.

The following interesting statement as to the method of action of emulsions of crude carbolic acid as larvicides is an extract (Jan. 1915, p. 8) from the Report of the Department of Public Health of the Panama Canal :—

"The emulsions as they are prepared with rosin soap are suspensions of minute particles which, when external influences are eliminated, must be considered to remain unchanged in composition regardless of the dilution. As they are formed when the proportion of water to the undiluted liquid is approximately 2 to 1, each particle must contain a relatively high proportion of toxic substances.

"The emulsions behave as typical emulsoid colloids. The particles display an energetic Brownian movement ; with a membrane permeable to electrolytes, they exert a definite osmotic pressure ; and they also carry a negative charge of electricity, migrating to the positive pole under the influence of an electric current ; when this charge of electricity carried by the particles is removed the emulsion is destroyed. The electrical nature of the particles is essential to their existence, and it is also a factor in the suppression of the specific chemical nature of the substances composing them. It also is very closely connected with the high bactericidal value of such emulsions.

"Bacteria possess this same electrical property, but with this difference, the nature of the charge is very easily reversed. In an alkaline medium it is electronegative, and in an acid medium it is electropositive. In the presence of the particles of an emulsion of crude carbolic acid with soap, in an alkaline medium, the charge becomes positive and under the influence of the current the bacteria will travel to the negative pole. They become positive in the presence of the negative colloid and remove the charge from the particles of the emulsion. This removal causes the particles to break up, and the constituents of the emulsion are liberated around the bacteria in a concentration out of proportion to the degree of dilution."

Anti-Malarial Measures in Madras City.

Much concern was exhibited two years back by the Madras Corporation owing to a considerable increase of mortality from malarial fevers. A malarial survey was made as far back as 1903 ; but neither the evidence then accumulated nor the testimony in 1900 of Major CORNWALL, I.M.S. (then Health Officer) as to the important rôle in malaria of open wells in the City served to invite much attention, in the "absence of funds." Under the present regime, however, anti-malarial work under the superintendence of Capt. A. J. H. RUSSELL, I.M.S. (who was placed on special duty for the purpose) has progressed energetically. Thus, in the last quarter of 1914, nearly 4,000 wells were stocked with fish, and 295 tanks have been cleaned twice or thrice. Many of these are of areas exceeding 100,000 square feet. These tanks have been stocked with larvicide fish.

The commonest malaria-carrying mosquito in the city is the *A. culifacies*, as first identified by CHRISTOPHERS and STEPHENS in connection with their survey of Enmore, which is within a few miles of the city. But, smaller numbers of the following are also found :— *A. ludlowi*, *stephensi*, *fuliginosus*, *listoni* and *nigerrimus*—the *A. stephensi* being particularly the inhabitant of wells.

The effect of these measures is so far favourable, but neither the lapse of time nor the extent of the statistics suffice as yet to give a decision.

Fish as Larvicides.

In a recent sanitation number of this *Bulletin* (Vol. 5, No. 3, p. 151) will be found certain observations by Mr. H. C. WILSON, the Expert Pisciculturist to the Madras Government. The Madras Fisheries Bureau has now issued a brochure embodying further remarks by this officer on fish as larvicides.

On the subject of preventing ponds (so-called "tanks" of India) becoming breeding grounds for mosquitoes, he urges that "the margins of ponds, etc. be trimmed, and overhanging plants that reach to the surface of the water should be cut back, as these tend to hold up debris and protect the larvae." He particularly requires attention to a point that is very often overlooked in such work, namely, that where ponds are concerned, it does not suffice to go through the ceremony of trimming the edges and stocking with fish, but that the foreshore and neighbourhood should be thoroughly searched for petty pools. When these cannot be filled in, he advises the expedient of draining them into the tank. Where it is not possible either to fill or drain borrow pits, he advises linking them up by open channels discharging into the borrow pit at the lowest level, and keeping these drains free of weeds and debris and stocking them with fish. On the advent of the hot weather, the chances are that the borrow pit at the lowest level would retain water, and in this would be found the fish—as they would retire with the receding water. He would apply this same principle to swamps which are not readily eradicated by drainage, by constructing "a pond at its lowest level and draining the swamp by open trenches into the pond."

He supports the great advantage of stocking open wells with fish, and quotes the case of the town of Cuddapah (a notoriously malarious place) where he found that 50 per cent. of the wells were infested with larvae of the *A. stephensi.* As to paddy-fields, he revives, from the malarial point of view, the plea so strongly made by the late Mr. THOMAS, I.C.S., the author of the "Rod in India," who showed how essential it was for economic reasons to prevent the wholesale trapping of the small fry of fish in rice-fields. It is significant in respect to the freedom from malaria of the highly irrigated districts in the South of the Madras Presidency that "in the Tanjore District and up the West Coast where fish is plentiful and the paddy fields are not trapped, they simply swarm with small larvae-eating fish, especially Haplochilus."

The following experiment conducted by Mr. Wilson is of interest in reference to the judicious use of tidal waters :—

"I discovered a salt water pool on the shores of the backwater with one living mass of larvae. As their breeding areas had been restricted the mosquitoes had evidently bred in this small pool in thousands. It was shallow, not more than 6 to 8 inches at the deepest part, but was cut off from the backwater by a small sandbank. I divided this pond into sections and cut a channel from one into the backwater deep enough to allow small fish a clear passage. I removed all sea weed and debris from both sections and examined the following morning. Fish were found in the one section and most of the larvae were destroyed, only a few remaining in the shallowest portion ; whereas in the other isolated section they were teeming. The sides of the former were sloped to make it deeper round the margins and the same evening an examination proved the fish had cleared the lot of larvae out of the section opened to the backwater. Backwaters

as a rule when open to the sea contain an abundant supply of larvicides in the way of small fish, and an examination along the shores where fish have free access will prove that there are very few larvae."

In regard to stream beds, he advocates the usual method of securing definite channels free of weeds at the margins; and where rock is dealt with (in the hollows of which small pools form) he would use dynamite, the chisel to form small drains, or filling of the bottoms with cement.

As to drainage channels on the sea coast, he advises the removal of obstruction and the deepening of channels when necessary, so as to place them under tidal influences and the action of fish.

The economy of fish as larvicides.—In the *Bulletin* above referred to, at p. 152, it was shown that, provided the sides are well and systematically kept, there may be cases where filling in of ponds at an unusual cost may be usefully put aside in favour of fish larvicides. In this matter Mr. WILSON, as a pisciculturist, also insists upon the superiority of the method to the use of cresol or petroleum as larvicides. His experience however largely concerns the treatment of ponds and pools, where labour is confined to margins of water within banks in small areas. But where drainage channels which may extend over many miles have to be treated, the subject assumes another aspect. Mr. Le PRINCE, Chief Sanitary Inspector of the late Isthmian Canal Commission, thus deals with the subject :—

"In order to keep a ditch of low grade, or a stream, perfectly free from vegetable growth and algae, so that the fish may have access to all parts of it, it would be necessary carefully and properly to clean out such a ditch or stream about every ten days. As we have had many miles of streams and ditches near settlements, the process would be excessively expensive. . . . . In many cases we have cleaned the banks of rivers of vegetation and all in large numbers, but many of the anopheles larvae take care of themselves and live in spite of the fish being present. They live under small stones and in the mud. The fish miss so many of them that we cannot rely on fish here, if we expect to reduce the larvae to a minimum. The smallest of these same fish (one inch long and larger), if placed in a jar of water containing larvae, will take thirty or more in twenty-four hours, and yet in the streams they cannot accomplish the results that we are expecting and are achieving. . . . . We are obtaining good results in using larvicide as per above formula in running streams by making weekly applications. . . . Unfortunately, we kill the fish by this operation, but then on the other hand, as the fish cannot perform the desired results which we are otherwise accomplishing, they have to go."

Natural enemies of the mosquito.

Mr. WILSON states that the *Daphne pulex*, a minute crustacean, attacks both small fish fry and the larvae of mosquitoes. The method adopted by the crustacean is in this case "the nipping off or pulling out the long lateral hairs until the larvae were unable to regain the surface and so dropped to the bottom, where they were seized and evidently their vital juices extracted." He also claims the larvae and full grown beetles of the Dytiscidae and the *Notonecta glauca* as mosquito enemies.

Malaria and the Birth Rate.

At page 427 of this *Bulletin* (Sanitation Number, Vol. 4, 1914) reference is made to the results of introducing irrigation into an area

without due recognition of the necessity for not only taking the water on to the soil, but draining off the surplus. The increase of malaria in the area of the Mon Canal, Upper Burma, subsequent to its opening in July 1911 was described. Lt.-Col. C. E. WILLIAMS, the Sanitary Commissioner, now reports (1913) that great improvement has resulted from the construction of main drainage channels and culverts, but it is yet too early to judge of the effect upon malaria prevalence. In the meantime, the epidemic has been sufficiently severe to show its effects on the birth-rate. He states :—" Thus when visiting Kyitkaing Village, which was most severely affected by the disease in 1912, I found that there were only 8 births on the register against some 32 in the preceding year. Close enquiry showed that there had been no omissions to register births."

Irrigation and Drainage.

" Indian Engineering " (Calcutta) in articles discussing " Punjab Irrigation " and the " Evils of Irrigation " (April 24, 1915) affords information showing that the great importance of irrigation projects being accompanied by provision of methods for removal of surplus water, in the interests alike of malaria prevention and agriculture, is being held in mind by the Government of India. It states :—

" Of important schemes about to be undertaken is one connected with the utilization of the surplus water of the Sutlej river ; another is the Amritsar Hydro-electric Irrigation Scheme designed to substitute pumping of the sub-soil water for the flooding of a track with canal water which is already suffering from waterlogging. It will be remembered that complaints have been rife for some years past of the growth of such tracts in the canal irrigated areas of the Punjab, leading to the spread of malaria and abandonment of cultivation. The attention of Government has now been concentrated on these drawbacks to free irrigation, and measures are to be taken both to restrict irrigation and to drain water-logged soil. Perhaps the temptation to spread canals over a country that pays so handsomely for water has been succumbed to somewhat indiscriminately, and it will be necessary with all future canal schemes to make provision against water-logging in the preparation of each project instead of having to find remedies for it afterwards. Another end that has been seriously tackled is seepage, since the benefits of lining of channels has been proved experimentally. When this work has been carried out on a large scale we are sanguine it will raise the capacity of the canal systems by an appreciable percentage."

This reversion to the policy recognised by the Honourable East India Company in 1855 will be welcomed by sanitarians as a solid instalment of sanitary reform in India in 1915.

PLAGUE.

Plague Immunity of Localities.

Madras City has been described as immune to plague ; it has not been so in the past, and it is very unlikely to be so in the future. Rangoon, Burma, was free from plague up to 1905, although in communication with plague infected ports in India and China. Ceylon was classed as immune till 1914, when its importation of Madras coolies probably underwent change of completeness with reference to the Indo-Ceylon Railway. Hyderabad City, Deccan (elevation

1,690 ft.) by forceful quarantine measures against the lower orders was, in the midst of infected country, free from 1898 to 1911, notwithstanding large merchandise traffic. Travancore territory adopted the Madras Plague Regulations; it is possessed of much elevated country; notwithstanding its free communication by land with the infected Malabar and Coimbatore Districts, it still remains free. In the United Provinces, Banda was long considered immune and, of special interest in the grain theory of spread, has yielded this year. Bettiah, in Behar and Orissa, has also been recently attacked for the first time.

The whole of the Madras Presidency was free from 1896 to 1898, whilst plague ran riot in the adjacent territory of Bombay. During that period, the only merchandize (including in that term grain and other food material) prohibited from free interchange was second-hand gunny bags and rags. The determining factor was the sudden movement of numbers of panic-stricken human beings from closely adjoining infected foreign territory. Guayaquil has been duly attacked with plague, and is now wondering why this disease has not yet spread to the mountains of the interior. The people of Guayaquil therefore (to meet local requirements) have inverted the recent immunity theory of the Plague Investigation Committee.* In the U.S.A. Public Health Report for 1914 (p. 169) it is stated "the altitudes of the interior still resist the invasion of this disease and as *rats and fleas are abundant*† it is supposed that the cold is the factor most concerned."

Perhaps, however, the nearest analogy to conditions required in the theory of immunity which the Ninth Report of the Plague Investigation Committee has excogitated, is in respect to Mombasa—the long immune. The coast of the East Africa Protectorate possesses, as classified officially by the Principal Medical Officer (Dr. A. D. MILNE) a mountainous zone, a desert zone and a coast zone—all differing considerably in meteorological details. At Kisumu, and at Nairobi in the mountainous zone, plague has prevailed from time to time; but Mombasa, in rail connection with these and in communication with plague infected ports, remained immune. Then arose the theory that whilst plague might prevail at Nairobi, it could not establish itself at Mombasa by passing through the Coast Zone; Mombasa could only be invaded by sea. But, unfortunately for this theory, after careful investigation Dr. A. D. MILNE (supported by Professor SIMPSON) shows that the chances are that the mountainous zone infected the Coast zone in 1912‡.

For the sanitarian the moral as to theories of plague immunity depending upon climate is "wait and see"; and, whilst recognising climate as a minor ally, when invasion is threatened by overland routes, to protect the rats in disease-free areas from infection by man, as ordinarily the more numerous and longest distance traveller and possible flea bearer, and to protect man against the infected rat and its fleas, as comparatively rare and unwilling transportees in particular articles—attractive for food or shelter. On land, in long distances, man is the chief plague bearer to the rat; in short distances, the rat is the chief plague bearer to man.

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*See this *Bulletin*, Vol. 5, p. 389.

†Italics not in the original.

‡Report on Sanitary Matters in the East Africa Protectorate, etc., by Prof. W. SIMPSON, C.M.G. 1915. p. 79.

The Climbing Powers of Rats.

The Report (for January 1915) of the Department of Health of the Panama Canal gives an instance of rat athletics. In a rat-proof building, a large rat "came from behind a counter, jumped upon the same and from thence to the wall shelves. Continuing he jumped several feet to a drop-light wire, up which he ran, thence along a 1-inch water pipe where he disappeared on his way to the second floor." During an enquiry in a Devonshire village and neighbourhood, where many of the house walls were formed of mud freely traversed and inhabited by rats, the writer was assured that in a rat haunted slaughter house a man sat still on being approached by a rat, and was used as a ladder to reach a roof beam. The farmers in the Deccan Districts of the Madras Presidency when retired to rest at night, regard the scampering of rats over their bodies as a matter of no moment. These farmers are not immune from plague.

Anti-Rat Fumigation in Ships.

The U.S.A. Public Health Report for 1914 records that, in Philadelphia, the use of carbon monoxide instead of sulphurous gas has lowered the time of necessary detention of ships by one half. The Harker apparatus is employed "and its administration is simple, provided its danger to human beings is never forgotten." The Cuban authorities prefer the use of hydrocyanic acid gas for vessels "docked at Habana and bound for Cuban ports." On the other hand, for vessels leaving Cuban ports for the United States sulphur fumigation is employed.

Eviction of Rats.

On the Panama Canal, a one gallon oil can, to which has been attached a three-eighths inch wide rubber tube, is being used successfully as a formaldehyde gas generator. Permanganate of potash is added to the formalin and the fumes are transmitted by the tube into burrows, causing the rats to bolt; then they are killed by men with clubs.

Typhoid.

The belief in prevention being better than cure is not undergoing weakening on the Panama Canal. The Annual Report of the Department of Public Health for 1914 states—"In the latter half of the year a periodic physical examination including urine and faeces, has been made of all food handlers in the kitchens, mess-rooms and commissaries of the Panama Canal, with the result that one typhoid carrier and a number of cases of contagious diseases were detected and eliminated."

Helminthiasis.

Ankylostomiasis; incidence by race.

The Philippine Islands are as great a resort for various tropical races as Port Said would seem to be for those of temperate climates. Hence the examination of aliens and steerage passengers on arrival

to the extent of 6,776, affords good material for ascertaining the proportion suffering from ankylostomiasis. According to reports of examination* positive results were secured in Chinese, 2·42, Japanese, 0·78, Indians, 8·49, Malays, 6·70 per cent.

The Report of the Department of Public Health of the Panama Canal for November 1914, draws special attention to the fact that in 1905, when routine post-mortem examinations were commenced, Columbians were proved infected to the extent of 80 per cent. and West Indians 52 per cent. By 1912, the infection of Columbians had decreased to 58 per cent. and West Indians to 34 per cent.—a result which is ascribed to treatment in hospitals, and "to the relative absence of soil pollution in the Canal Zone and the resulting infrequency of new infection."

The Eradication of Ankylostomiasis.

British Guiana has been the fortunate recipient of the practical and philanthropic efforts of the Rockefeller Foundation International Health Commission, in a campaign against ankylostomiasis. In a country so largely depending upon imported labour of Asiatics, who show so high a ratio of infection, the subject becomes one of great economic importance. The local authorities have already shown the great advantage of special measures in reducing this disease amongst unindentured labour, and these have been attended with great saving of life. The Commission therefore have confined their efforts to the more difficult problem of treating the general population. For success it was desirable to secure that all persons should consent to treatment, which implies the application of both power of organisation, and much tact. Their experience led them to direct that a "unit of operation" should be :—

"A territory with—

"(*a*) Legal or natural boundaries.

"(*b*) An aggregate of population of not more than 15,000, and fewer if sparsely inhabited. This is probably the maximum which can be properly handled by one Medical Officer and clerical force.

"(*c*) A Central Office, situated near the centre of the District, where most of the clerical and microscopical work may be done, and where the large record books may be kept, as it would entail much loss of time and expense to move the Central Office outfit from village to village during the progress of the work."

A census of the inhabitants of the selected area was taken. For each 1,200, one male nurse and one assistant were appointed "for the purpose of administering thymol." Previous to commencement of treatment, these persons served as census takers. Besides administering thymol, they carried out night soil conservancy inspection. They issued to each person for specimens of faeces to be gathered by them, according to roster, "a one-fourth ounce container with paper inserted in the lid, obtainable from the Myers Manufacturing Company, Camden, N.J., U.S.A." They are inexpensive "and in general use for this purpose." For examination of faeces, a centrifuge capable of accommodating 20 specimens at a time was employed. For microscopical examination three young natives of India were trained, and found sufficient for work in a population of 14,000.

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* United States Public Health Service Report for 1914, p. 218.

A fair trial was given to the "daily" method of treatment with thymol and the intensive method. The Commission concludes in favour of the latter thus :—

"1. The 'Intensive' treatment presents less difficulty as an administrative problem.
"2. It cures a larger percentage of those infected.
"3. These cures are secured at a smaller per capita cost."

Ankylostomes in Soil.

Dr. LEIPER, writing from the Helminthological Department of the London School of Tropical Medicine in January of this year, holds out hopes that, as a result of experiments under conduct by him, it may be possible by "employing chemical manures to destroy ankylostomes in faeces without impairing the organic manurial value, and that if laboratory experiments support this view there may result" a simplification of the night soil problem in tropical countries.

Schistosome Experiments.

At Hankow, the Expedition of the London School of Tropical Medicine secured a dog infected with *Schistosoma japonicum.* With this source available for material Dr. LEIPER and Surgeon ATKINSON state* that search was made for the special species of mollusc which presumably would form the intermediary host of the trematode. For this purpose, a visit was made to Katayama, Japan, which is an agricultural area recognised as suffering greatly from this disease. A markedly common form of mollusc in this area was detected as a probable bearer of the Cercariae. This mollusc, named the *Katayama nosophora,* was proved to have a definite chemiotaxis for the newly-hatched trematode embryo. The following conclusions were formed :—

"These experiments, carried out with the greatest precautions to avoid fallacy, convince me that the Looss hypothesis (which for so long has dominated scientific opinion, and which supposes that infection takes place by direct contamination with newly hatched embryos without the intervention of an invertebrate host) is entirely erroneous, and that prophylactic measures based thereon would be wholly inefficient. The life cycle of the *Schistosoma japonicum* conforms in essential respects with that of other trematodes. It remains now to be demonstrated that *Schistosoma haematobium,* the cause of bilharzia disease, follows a similar course."

In reference to the last sentence, the War Office has asked for Dr. Leiper's services to study bilharzia disease in Egypt. This work, with the experience recently gained in China and Japan, must, with ordinary good fortune, provide definite results, and the possibility of concentrating practical sanitary effort upon a disease which may, in the absence of such efforts, in the near future become a source of anxiety on the ever-increasing routes of commerce. That it is necessary to refer to good fortune attending a scientific investigation, is evident from Dr. Leiper's report. The subjects of his

* Report of the Advisory Committee for the Tropical Diseases Research Fund, 1914. London: Printed under the Authority of H.M. Stationery Office by J. J. Keliher & Co., Ltd. See also Brit. Med. Jl., 1915, Jan. 30, p. 201.

experimental infections were mice, and these valuable possessions were kept in his cabin *en route* for England. But one of the instinctive haters of mice, in the form of a "lady in a neighbouring cabin" demanded their relegation to the ship's butcher for care, with the result that at the end of the voyage only one precious animal survived. It was, however, on arrival in England honoured by a special post-mortem in the presence of Drs. Leiper, Sandwith and Haenschell. As a result Dr. Leiper was able to report:—"Living Schistosoma, male and female, worms were then demonstrated in numbers in mesenteric vessels."

Rabies.

Anti-rabic Inoculation.

The Director of the Pasteur Institute for Southern India (Major J. W. Cornwall, I.M.S.) in his Report for 1914 enters into several interesting details as to results of treatment during 1907 to 1914. In that period, 5,480 persons (4,674 males and 806 females) have been subjected to anti-rabic treatment. Although he places no stress on the subject, he shows that it "may be noted for what it is worth that the hottest and driest months, namely, March, April, May, June and October provided the least number of patients." Of the 5,480 persons treated, 8 died of hydrophobia during the course of treatment, 18 developed this disease within 15 days of the end of their treatment, and 42 more than 15 days after the treatment. Of the fatal cases, 14 had been bitten on the face. He furnishes a table of ages of subjects, showing the curious fact that there are periods of greater susceptibility to hydrophobia in childhood and again in later life, and that young adults are the least likely to develop it.

A scheme was instituted in communication with local authorities to ascertain histories of persons bitten and treated at the Institute, and of those bitten but not treated. The data collected are not sufficiently large to give a definite opinion; but so far it would appear that, amongst 169 persons treated at the Institute, 5 deaths occurred from hydrophobia, or about 3 per cent.; whilst amongst 275 untreated, there were 20 deaths, or 7·2 per cent. He then states that the figures "suggest that, as was suspected when the enquiry was undertaken, the ordinary statistics of this Institute are misleadingly inaccurate, and I would go so far as to assert that a similar condemnation is applicable to the published statistics of many other Institutes."

In the Antirabic Institute, Egypt, during 1913, among 609 cases in which the diagnosis of biting by rabid animals was established by laboratory work and microscopical smears, or by the evidence of skilled witnesses, treatment was by the cord attenuated in glycerine for at least twelve days. Previously, attenuation for only three days had not proved satisfactory. In cases of injury of the head and bites on other uncovered parts and, occasionally, when the bites are through clothing, seropathy is combined with vaccination "and during the first three days of treatment a mixture is injected of equal parts of decimal emulsion of fresh cord in physiological water and anti-rabic serum." Two deaths occurred more than fifteen days after treatment, and "fourteen cases occurred during treatment or less than fifteen days after its termination."

Beriberi.

In the Thirteenth Annual Report of the Institute for Medical Research, Kuala Lumpur, the Director (Dr. Henry Fraser) in discussing the subject of beriberi invites attention to two matters, which he considers it desirable those investigating beriberi should hold in mind. Firstly, he would require that the loose term "pericarp," ordinarily used in defining the portion of the grain the more or less complete removal of which in polished rice conduces to beriberi, be more generally recognised as referring to the "sub-pericarpal layers." Again, where confusion between the beriberi resulting from deficiency arising from absence of these sub-pericarpal layers and other somewhat similar diseases exists, he would remind investigators that "beriberi is only a form of polyneuritis and students of this disease know that not only forms of polyneuritis of different origin have been called beriberi, but that diseases of which polyneuritis may not be a prominent feature such as "epidemic dropsy," "Ceylon beriberi" and the like have been included under this name."

It is a fair deduction from the effects of milling on the sub-pericarpal layers of rice that moulds may bring about almost the same result. Instances of this causation have been referred to in previous (Sanitation) numbers of the *Bulletin.*

The following is further evidence in the same direction by Lieut.-Col. Harriss, I.M.S., in his Report as Acting Sanitary Commissioner for Burma in 1909, p. 17 :—

"During the rainy season a severe outbreak of beriberi occurred among the coolies engaged in the construction of the new lighthouse at Beacon Island off the coast of Arakan, resulting in a number of deaths. . . . . In this instance damaged and insufficient food-supplies appear to have been responsible for the outbreak, which was intensified by the inclement character of the weather and the discomforts and isolation inseparable from residence on a barren island during the rainy season. Outbreaks were reported as having occurred among the Chinese coolies employed in the tin mines in the vicinity of Victoria Point and similar outbreaks occurred among gangs of labourers employed by timber companies in the forests of the Myitkyina and Upper Chindwin Districts. In every instance suspicion attached to the damaged rice supplied as rations to the labourers, and specimens of this grain sent to the laboratory at Kasauli for examination were reported on as being mouldy and unfit for food."

According to the U.S.A. Annual Public Health Report for 1914 (p. 163) the Japanese liners arriving at the Philippine Islands "almost without exception [reached port] with cases of this disease amongst the crew. . . . . A varied diet is furnished in these vessels and polished rice is not used."

On the Panama Canal, in 21 cases of suspected beriberi* it was considered diet was not connected with the disease. On the other hand, in the Annual Report for the Panama Canal for 1914 (p. 10) the following statement occurs :—

"A sanitary survey of the town of San Miguel, Pearl Islands, Bay of Panama, was made in November. . . . . The information was elicited that beriberi, which used to be rife among the pearl fishermen, was never encountered among the naked divers, who returned daily to the islands, but was met with exclusively among the contract divers, who used the helmet and were quartered and fed on boats which cruised around the islands, subsisting partly on canned provisions, and who frequently remained for months on the boats before coming ashore."

*Report of the Health Department for December, 1914.

The Wollaston and Kloss expedition quoted by Dr. Fraser is of course a classical instance of the undesirable influence of milling in aiding deficiency disease. These explorers journeyed into the interior of Dutch New Guinea. Previous expeditions by others had signally failed owing to outbreaks of beriberi. The staple grain used in the former expeditions was polished rice. Wollaston and Kloss used unpolished rice. Dr. Fraser states :—" The expedition was in all of seven months duration, and despite the laborious nature of the work, among the 204 rice-eating natives no single case of beriberi occurred." The total diet used on this expedition is given ; although it does not materially weaken the case, the contrast of the diet used by former expeditions with all items as to nature and amount would have been desirable. Probably, such information could not be procured owing to lapse of time.

The following is a statement by Lieut.-Col. C. E. Williams, I.M.S., Sanitary Commissioner for Burma, in his Annual Report (p. 13) for 1913, which would go to support the theory of moulds or other cause affecting the nutritive value of the sub-pericarpal layers :—

" In August and September a small outbreak took place at the Imperial Police Training School, Mandalay. A change was made in the rice supply and this was followed by a cessation of the outbreak, though it cannot be said to be clearly established that this was dependent upon the nature of the diet. Many cases occurred at this period in the town, mostly among the poverty-stricken classes. Although all Civil Surgeons admit that the majority of sufferers from beriberi eat rice of doubtful quality, and that the disease is probably associated in some way with this diet, cases are frequently observed in which diet appears to play no part. Thus the Civil Surgeon, Akyab, asserts that he has treated cases of this disease in well-to-do persons living on a rich mixed diet, and the Civil Surgeon, Bassein, has seen the disease in Burmese villagers who do not eat milled rice, and habitually use a mixed diet which elsewhere does not lead to outbreaks of the disease."

Sand and Water.

The Hindu Shastras direct attention to earth and water as purifying agents for domestic metal vessels. In conditions of life removed from defilement by scrupulous adherence to rulings by all concerned, these agents are doubtless valuable for the purposes indicated ; but, with the passage of time and altered conditions of modern life, the Hindu obeys the letter but not the spirit of the ruling. It is quite a common event to find a high caste Hindu, who would not approach within yards of a lower caste fellow countryman lest he be polluted, fail to perceive that in using earth or sand and water from places no better than public gutters risk of pollution is run. In the houses of Europeans in India, it requires a good housewife to make sure that metal vessels used in the kitchen are not *cleansed* with wood ashes, mixed with earth gathered by the cook's assistant within arm's length of the kitchen door, which has been defiled for generations by slops and the bare feet of servants who visit by no means cleanly latrines.

The writer has known local authorities in charge of public water filters, content to leave to contractors the choice of sites where the sand could be obtained. In one instance, where typhoid had previously existed amongst European troops, he found the selected site for the filter sand was the bed of a river forming the usual morning *place d'aisance* of a large village population.

It is obvious that, irrespective of the chances of contamination of vessels by typhoid and cholera matter, under such conditions risk of infection by intestinal parasites, more especially ankylostoma, is considerable.

Major T. Forrest, R.A.M.C. (T.)* produces a concrete example of such undesirable methods of purification of vessels, by quoting an outbreak of diarrhoea in two companies of the 16th Battalion H.L.I. when in camp at Gailes, Ayrshire. It was possible for him to exclude both the water and food supply as the cause of the condition. He was finally able to show with the aid of exhaustive bacteriological examination by Dr. R. M. Buchanan, City Bacteriologist, Glasgow, that the outbreak was due to local contamination owing to the " camp kettles being scrubbed with sand picked up indiscriminately. Clean sand was provided, and orders issued that it only was to be used for scrubbing purposes. Thereafter no further cases occurred." That no further cases occurred is sufficient presumption that the new sand was procured from a sanitarily safe place; but the moral certainly is that, in practice, there should be no doubt as to the actual site of origin of apparently clean sand.

Nor does the question of sand and water concern only the Hindu or the British soldier. Before reciting prayers, the Mahomedan should undergo purification, the least of which, known as " waza," consists of ablutions with water of the ears, arms, hands and face. If the shoes are defiled, they should be purified by earth. If however water be not available for ablutions, either sand or dust may be employed (Tayyammum). The chief desire is apparently that at least the hands, and arms as far as the elbows, be thus purified. In mosques, water is usually placed at disposal of worshippers in small open cisterns sunk below the floor level. As all and sundry use this water, it is obvious that it may form a disease bearing medium.

It is of course the foundation of treatment of races within the British Empire that no interference with their religious methods is permitted by the Governments concerned, provided neither inhuman practices nor such as are likely to disturb the public peace are in vogue. Consequently, suggestions for sanitary precautions in such matters must originate, or at least be carried out, with the full consent of the people of the religion concerned. In such matters, the Egyptian Government has to deal with a well educated class of Mahommedans, and it is satisfactory therefore to find that it has been possible for it to pass the Law of July 1st, 1911, which came into force in July, 1913†. This required the abolition of insanitary cisterns below floor level, known as " meidas," and in lieu " the installation of water taps, so as to ensure a supply of fresh water for each person."

Some Limitations in Water Purification.

Dr. Fraser, in his Annual Report of the Kuala Lumpur Institute for 1913, draws attention to the fact that the present day tendency is to obtain water supplies of towns from sewage polluted rivers, after

*British Medical Journal. 1915. March 13. p. 464.

†Egypt, Ministry of the Interior, Dept. Public Health, Annual Report for 1913, p. 36.

filtration through mechanical filters. He suggests that the purification of diluted sewage for domestic purposes has a curious fascination for some minds, and invites attention to the fact that, with a rainfall of 100 inches per annum and hills within reasonable distance of towns in the Malay States, there is no necessity to select, by preference, streams in the plains whose history of contamination permits of no doubt. To this the writer would add that, with so rich a rainfall (even allowing 60 inches evaporation per annum), if the hills were not in close proximity to the town, a large reservoir area would go well towards supplying a pure rainfall water supply. Dr. Fraser illustrates some of the difficulties which those determined to drink purified sewage have to encounter to secure their ends, as follows :—

"Recently a case came under our notice which illustrates the danger which may arise from the use of mechanical filters in this country. The water supply of a large town has hitherto been purified by the use of sand-filters. It was considered possible that by means of mechanical filters an equally if not more satisfactory filtrate would be obtained and an economy in cost effected. The raw water contains a sufficient amount of suspended material to render it faintly opalescent, but that opalescence is not removed as a precipitate by the use of alum. Consequently the water after passing through the mechanical filter was still opalescent and contained the most of the added alum. It was next attempted to remove the opalescence by the addition of a small quantity of soda-ash, but this substance causes the suspended matter to pass into solution and the water is cleared. The mechanical filter is therefore deprived of what is claimed to be an essential part of the process and it is obvious that for this water its use is not permissible."

Liquid chlorine is now available in the market in steel cylinders, holding about litres 100 of chlorine.* It exhibits itself in gaseous form on being released from pressure. Possibly, it is this form that has been used against our troops by the Germans†. Its more legitimate purpose is the supersession of the use of hypochlorite of lime for water purification. The advantages offered are the dealing with an agent of definite strength under a control that can be modified to meet varying conditions of water with promptitude, as contrasted with the use of unstable hypochlorite of lime.

It is apt to be forgotten that, although the chlorine process goes a long way towards sterilization, in practice, the term is hardly applicable. Mr. H. E. Jordan, Chemist for the Indianapolis Water Company, recently reported‡ that of 201 samples of water treated by hypochlorite of lime "21 gave positive *B. coli* immediately after treatment, 39 after 24 hours standing, and 42 after 48 hours."

Work at the Hygienic Laboratory, Washington, has shown that the use of the ultra-violet rays for purification also has its limits, in that the water to be treated should be absolutely clear.

Personal Prophylaxis.

Prophylaxis of Snake Bite.

Sir T. Lauder Brunton some time back represented to the Government of India that the use of permanganate of potash for treatment of

* Electro-Bleaching Gas Company, 25, Madison Avenue, New York City.

† Our troops should find these cylinders, if not a military, at least an excellent sanitary aid in purifying water.

‡ Engineering Record, New York, May 15th 1915, p. 621.

snake bite would be facilitated by the issue of a little instrument invented by him, to be carried in the pocket, and now known as "Brunton's lancet." In a wooden case is contained solid permanganate of potash and, in a separate compartment, a small lancet. The employment of permanganate of potash was first advised by Sir Joseph FAYRER in 1869. In 1881, Dr. Vincent RICHARDS carried out experiments on the subject and concluded that if permanganate of potash be used so as to come in contact with cobra venom at the site of a bite within four minutes of insertion, this could be rendered inert. He laid stress upon the requirement that in opening the wound made by the teeth of the snake the actual spot in the subcutaneous tissue should be identified by the dark colour immediately surrounding the insertion point. Sir Lauder Brunton's little instrument therefore offered the opportunity of the quick insertion of the permanganate Dr. Vincent Richards held requisite.

In accordance with Sir Lauder Brunton's advice large numbers of these "snake-bite lancets" have been issued by Local Governments in India. When, however, official reports were required as to their utility, it was realised that difficulty existed in deciding whether the snakes concerned in the histories of cases really were poisonous. The tendency is undoubtedly for excited spectators, or scared subjects of snake bites, to believe that the particular snake they have had a glimpse of which did the deed must be poisonous; for the same reason it is usually abnormally large. Scare is also so great in the belief that death is imminent, that not infrequently a patient is brought for aid in a state of collapse. Such cases are fruitful sources of fame and fees to the users of charms. Hence, both highly favourable and unfavourable reports were forthcoming. Thereupon, the Government of India deputed Surgeon-General (then Lieut.-Col.) BANNERMAN, C.S.I., to undertake a series of experiments at the Bacteriological Laboratory, Bombay, as to the efficacy of the permanganate of potash treatment. This officer conducted elaborate and careful experiments as to the effects of permanganate after bites, both by the cobra and daboia. The conclusions arrived at by him were :—

"1. That a dog bitten by a cobra cannot be saved by the local application of powdered potassium permanganate rubbed in after free incision of the bitten place; nor by a similar application of a solution of the powder.

"2. That it may be saved, however, by the immediate subcutaneous injection of 10 c.c. of a 5 per cent. solution of potassium permanganate; but this solution is so strong that gangrene of all the tissues of the foot is produced.

"3. That if this treatment be delayed for even two minutes, a fatal result cannot be averted.

"4. That a dog bitten under natural conditions by a Russell's viper cannot be saved by the local application of potassium permanganate, however applied."

The following statement by him would especially seem to render the use of this antidote hopeless :—

"It appears that potassium permanganate in solution does not act *in vivo* with the same effect as *in vitro*, and that even four times the amount that serves to neutralise cobra venom in a test-tube will not with certainty prevent fatal poisoning in an animal which has received 10 M.L.D. By employing the expedient of leaving the needle *in situ*, and fitting on to it another syringe containing the solution of potassium permanganate, it is certain that the utmost chance was given of getting the chemical into intimate contact with the venom it was designed to neutralise. The time of application was also immediate."

The following is an instance, in practice, of failure of the permanganate of potash method, quoted by the "Rangoon Gazette" of the 14th April of the current year :—

"A large cobra bit one of the prisoners in the foot as he was working in the jail rice-field at Myaungmya last October, writes a Myaungmya correspondent. The warder with the gang applied his lancet and permanganate, which they all carry and are taught how to use, but it availed little or nothing; Burmese medicine was also used with no better effect, for the man died well within the hour."

Anti-Plague Inoculation.

In a well considered and interesting Report on plague in Mombasa Captain D. S. SKELTON, R.A.M.C., shows that whilst all ordinary measures for the suppression of plague were carried out, a special effort was thought necessary to secure inoculation of the population with HAFFKINE'S vaccine, as the general sanitary condition and possibility of rat control were hopelessly poor. This was carried out so effectually that he claims that of a population of 30,000, 23,800 were inoculated. Between June and August, amongst a monthly inoculated average population of 12,000, the total attacks of plague were 15 with 12 deaths, whilst in the uninoculated average monthly population of 21,900 the total attacks were 121 with 103 deaths. Between September and November, re-inoculation was undertaken with the object of securing an increased immunity of the people—so that, on the 12th November, 1913, the inoculation state was as follows :—

"Primary inoculation	32,744
Re-inoculation	8,702"

Captain Skelton concludes :—"The vaccine used is Haffkine's prophylactic. So far as I know, not one single untoward result has followed. Considering that in many instances the operation has been carried out in not too favourable circumstances and under conditions which, if one has the choice, one would not select as highly desirable this result reflects credit on the inoculation staff for their care in trying to obtain asepsis." At the same time, even in the case of well inoculated populations, Captain Skelton shows that residence in insanitary areas affording special shelter for rats will inhibit the full benefits of inoculation :—

"Altogether, since the disease began in Mombasa 17 cases of plague have occurred among the railway employees living in the railway area; that is to say, there is a case incidence of approximately 10 per thousand. Compare this incidence with that of the general inoculated population (all railway employees have been inoculated at least once and the majority twice), which in August 1913 was 0·3 per 1,000. It is seen therefore that if one lives in the railway area the chances of getting plague are about 30 times as great as if one lived in the town."

Aseptic Vaccination.

Dr. CRAKE, Health Officer, Calcutta, makes the following remarks in his Annual Report for 1913, on Major WALTERS' proposal to use

tinct. iodine to secure an aseptic condition of the arm before inserting anti-smallpox vaccine :—

"I was disappointed to find that Tr. Iodi alone appeared to attenuate the vaccine. This was clearly proved by its effect on a calf, one half of its abdomen being treated with iodine and the other in the usual way. The vesicles on the area treated with iodine developed more slowly, were much smaller and fewer in number, and many insertions failed altogether."

The Cocaine Habit.

With certain races in the tropics, the use of opium is largely confined to the aged and infirm, with little or no tendency to increase the daily dose. With others, undoubtedly the stimulant influence is sought by excessive and increasing doses. Legislative interference is bringing into use substitutes. In certain areas the cocaine habit is consequently being formed by the people to a most undesirable extent, whilst those who were formerly addicted to opium now find solace in morphia injections (at so much per dose) administered by the vendor with a syringe innocent of sterilization during transfer from arm to arm. Germany is the great producer of the cocaine and, under existing circumstances of its trade, persons possessed of the "cocaine habit" are liable to find their favourite drug more costly than formerly. Hence the appearance in the market of other drugs. Mr. HANKIN, Chemical Examiner and Bacteriologist to the Government of the United Provinces in his Annual Report for 1914 (p. 2) after showing that, whilst in 1906, only 5 samples of cocaine were submitted for identification, in 1914 the number was 1,306, describes how a cocaine substitute "anaesthesin" was identified by him as follows :—

"A drop of a dilute solution of caustic soda is spread out on a glass slide and allowed to dry. If a small quantity of anaesthesin or of a salt of anaesthesin is placed on this film, covered with a coverslip and heated over a flame till it melts, then, on cooling, it crystallises with a very peculiar appearance. The crystals appear to be separated by cracks, and under the microscope are seen to contain minute cavities, often oblong in shape, and arranged in rows. No other cocaine substitute produces a similar appearance when treated in this way. Antipyrin does produce a somewhat similar appearance, but is very easily distinguished from anaesthesin by its solubility and chemical characters."

SANITARY ORGANISATION.

In the Second of the Chadwick Lectures given by Sir Ronald Ross,* the important question of sanitary organisation in the tropics was entered into. He insisted that Governments were apt to find an excuse for not taking sanitary action by laying down the principle that, until the people are educated, aid by the State would be premature. Yet he showed that, granting education of the people was a highly desirable aid to sanitary advance, it did not follow that sanitation would, or could be automatic. He holds that the value of education has failed to exhibit itself in the case of officials, who employ "non-experts for doing the business of an expert." In illustration, he showed that water offering breeding facilities for mosquitoes in localities under public control could not be got rid of by the individual parent for the protection of his child, neither could the educated parent control public sewerage, water-supplies, and public conservancy.

In sanitary interests, he deprecated the tendency in research to proceed on academic lines, and pointed to the necessity for the better direction of aid to applied hygiene.

In the matter of sanitary organisation, he held that the heads of the Medical and Sanitary Services should have positions in the Executive Councils of Government.

Finally, he referred to the common fault of regarding sanitary requirements as sufficiently fulfilled by forming Sanitary Services in which the higher grades were duly represented, whilst failing to supply the rank and file by which executive orders could be carried out.

It is a curious fact in the psychology of not a few civil administrators that they appreciate solely what may be regarded as the fireworks aspect of Applied Hygiene. They understand the physical strain and danger to life that accompanies energetic action in combating epidemics, and they see in disinfection—especially if accomplished by malodorous chemicals—the true rôle of the sanitarian. But except in this the hour of defeat (which an epidemic really means to the sanitarian) he is a negligible quantity—a faddist with the doctrine of "prevention is better than cure." Whilst then the sanitarian must ever hold in mind that, in tropical countries, the ultimate responsibility for proportionate expenditure of funds, and for preserving individuals and special races from undue interference by indiscrete exponents of Preventive Medicine, must rest with the authorities to whom advice is given, it is obviously essential in the public interest that such advice should be given under circumstances that will ensure its being duly weighed. The essence of this requirement is that all representations on sanitary matters must be made *direct* to the authority possessed of the power of government of the people concerned, and of control of the purse strings. The plea of Sir Ronald Ross that sanitation should be represented on the Executive Councils of Government is therefore to the point.

As far back as 1894 Professor W. J. Simpson, at the First Indian Medical Congress at Calcutta, suggested that sanitation should be represented on the Executive Council of the Government of India by a member of Public Health.

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* Journal of State Medicine, 1915. Apr. Vol. 23. No. 24, pp. 97–100.

Dr. W. Perrin NORRIS, writing in the Journal of the Royal Sanitary Institute, June 1915, p. 208, states : —

"In some of the States the Cabinets include a Minister of Health, and in that State in which the evolution of public health administration was for some time the most advanced there has been a Minister of Health with full cabinet rank, and Medical Permanent Head, for over twenty years.

"In that State, also, the central authority or State Board of Health is so constituted as to link it up with the local authorities, the Board consisting not only of Government representatives, but also of municipal councillors representing groups of municipalities, towns, boroughs and shires."

Again, if it be of advantage that representations in the interests of sanitation shall be made direct to the authorities concerned, no exception can be allowed in reference to departmental administration by interposing a man whose chief rôle is curative medicine. Curative and preventive medicine, except in petty charges, cannot without detriment one to the other be "run" by one individual. In civil administration no question of subordination need arise ; but, if it does, the branch which fulfils the rôle of chief public importance, namely, the sanitary, should be supreme. Sir Ronald Ross placed this on record as his view, in a paper read before the International Medical Congress of 1913.

Not only however is the present position of the sanitarian to civil administrative officers in the tropics such as to demand change if efficiency is aimed at, but his relation with other Departments requires to be better defined. To secure that Hygiene shall be "applied" by works it is necessary that Engineering skill be employed. The engineer so used should know sufficient about sanitation to appreciate the sanitarian's requirements ; the sanitarian, on the other hand, should know enough of engineering to feel assured that the works contemplated or executed meet his requirements. The engineer must therefore either be subordinate to the sanitarian or precise rulings must be in force to secure that their mutual relations are such as to obtain the best work of both, in the public interest, without such subordination. Sir Ronald Ross, in the paper referred to, considered that by subordinating both officers to government the end would be secured. This is true up to a certain point ; but as these two officers may differ in opinion and are not the holders of the purse strings, it is evident that local authorities must be allowed to express their views also. Hence, Sanitary Boards with governments are now recognised factors. Provided their functions are confined to discussion and approval of the Sanitary and Engineering, financial and legal aspects of major and sanitary works, such Boards are useful, as buffers between Governments and extreme sanitary and engineering experts. The tendency is frequently, however, for Sanitary Boards gradually to usurp duties which can only be correctly fulfilled by either the Chief Sanitary Officer or the Sanitary Engineer. This can only end in delay and, finally, inefficiency of sanitary administration ; and, whilst mutual consultation of all concerned on such Boards is of utility in securing compromises where huge sums of public money are involved, this will not suit the requirements of minor sanitary works.

For the latter there must be a very great demand in average tropical countries, with reference to temporary works for the sanitary care of

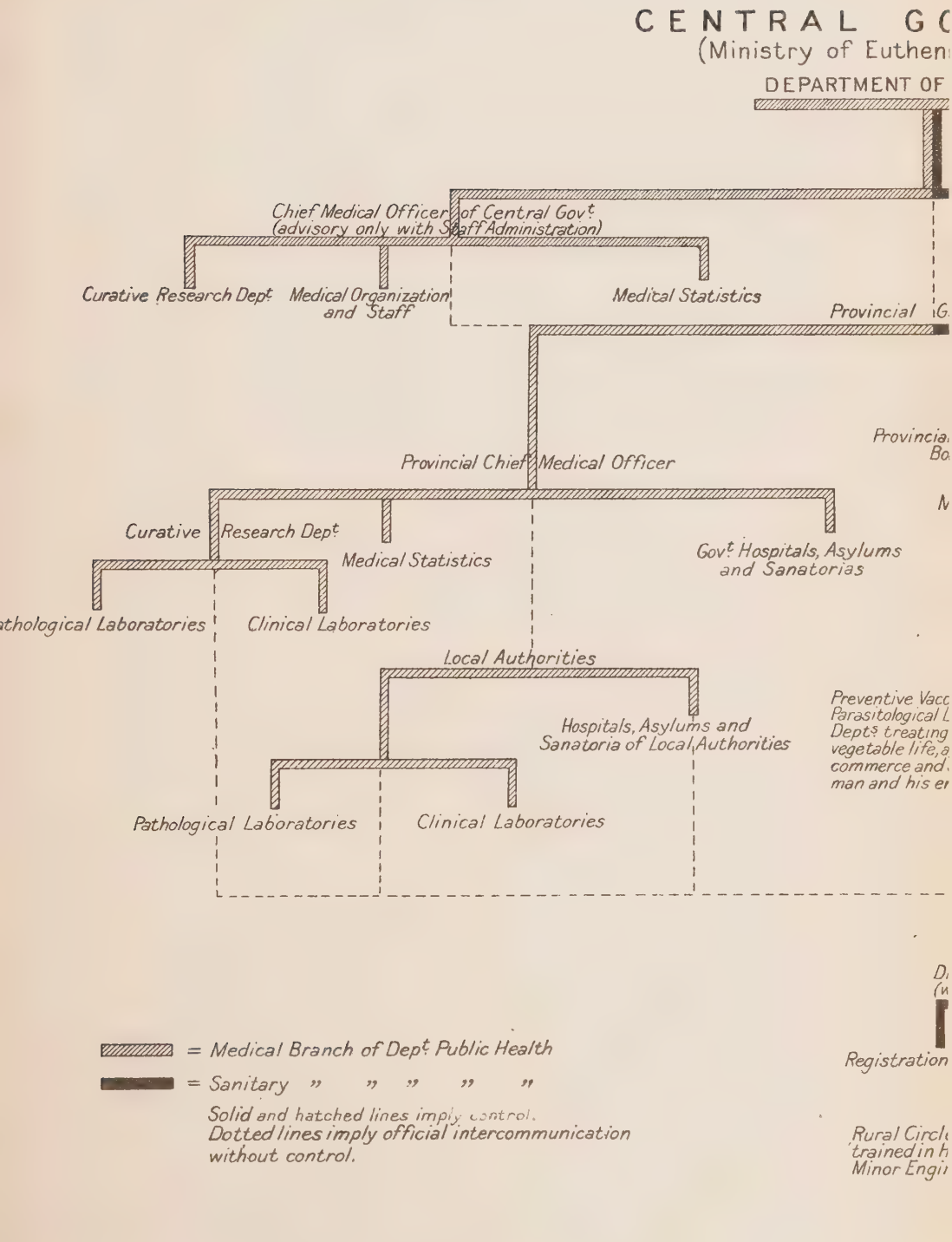
large assemblies, the making and maintenance of antimalarial works, minor water-supplies, village conservancy makeshifts, sewerage and the like. To secure, say, the making of catch drains to divert from depressions water that would be utilised by mosquitoes or to protect drinking water sources from sewage, might imply correspondence and the scrutiny of estimates and shelving of the remedy for months if not years, if it had to be referred to the local authorities as well as the Sanitary or other Engineer. Further, if so referred, there would result an increase of establishment of Engineer subordinates *out of all proportion to cost and nature of works to be fulfilled.*

If the Sanitary Officer is to make, after a sanitary survey of a locality, suggestions for sanitary works either major or minor, he should be prepared to furnish plans and, if possible, approximate estimates sufficiently sound to render their engineering feasibility possible of discussion. Failing this, not only will delay occur in preliminary discussion, but an engineer sent to the spot alone, or even in company of the Chief Sanitary Officer, may be absolutely misled as to what is required. It follows that if the Sanitary Officer be provided with an engineer subordinate attached to his own office, he is in a position, when on tour, to suggest new major works to be elaborated in consultation with the Sanitary Engineer and to be designed and executed by that officer after a consideration by the Sanitary Board, or on his own initiative to design or correct designs of his subordinates, and to cause the execution of such minor works as are within the powers of his staff. For this end, *all the superior grades of Sanitary Inspectors*, in rural areas at least, should besides their sanitary training have undergone a course of minor engineering that would enable them to take levels and to estimate for and construct minor works.

Thus, Professor W. J. Simpson, in his recent "Report on Sanitary matters in the East Africa Protectorate, Uganda and Zanzibar," points out that sanitation in these areas has now become of such importance to their future economic prosperity as to require full and separate sanitary and medical staffs under separate heads, each corresponding direct with the Local Government; only when the charges are small does he suggest the "doubling up" of medical and sanitary duties, and then he makes it clear that for medical duties an officer shall correspond with the Head of the Medical Branch and, for Sanitary duties, with the Head of the Sanitary Branch of the Public Health Service. He thus deals with the important subject of sanitary works:—

"The Chief Sanitary Officer should have an Assistant Engineer with ministerial staff as a technical assistant, who would travel with him, and be prepared to make estimates for petty works, and verify data for any sanitary engineering suggestion for major works which the Chief Sanitary Officer would desire to represent to Government. The Chief Sanitary Officer and his staff would be responsible for petty works, and it would rest with the Sanitary Engineer to deal with the estimating and execution of major works. No major works should be suggested by the Sanitary Engineer to Government, without the whole matter with plans in detail being placed in consultation with the Chief Sanitary Officer. Such major works thus discussed would pass finally to the Sanitary Board, who, with their opinion, would forward the whole scheme to Government for sanction."

The ideas therefore of sanitary organisation in the Tropics expressed by Sir Ronald Ross and Professor W. J. Simpson are not procrustean,



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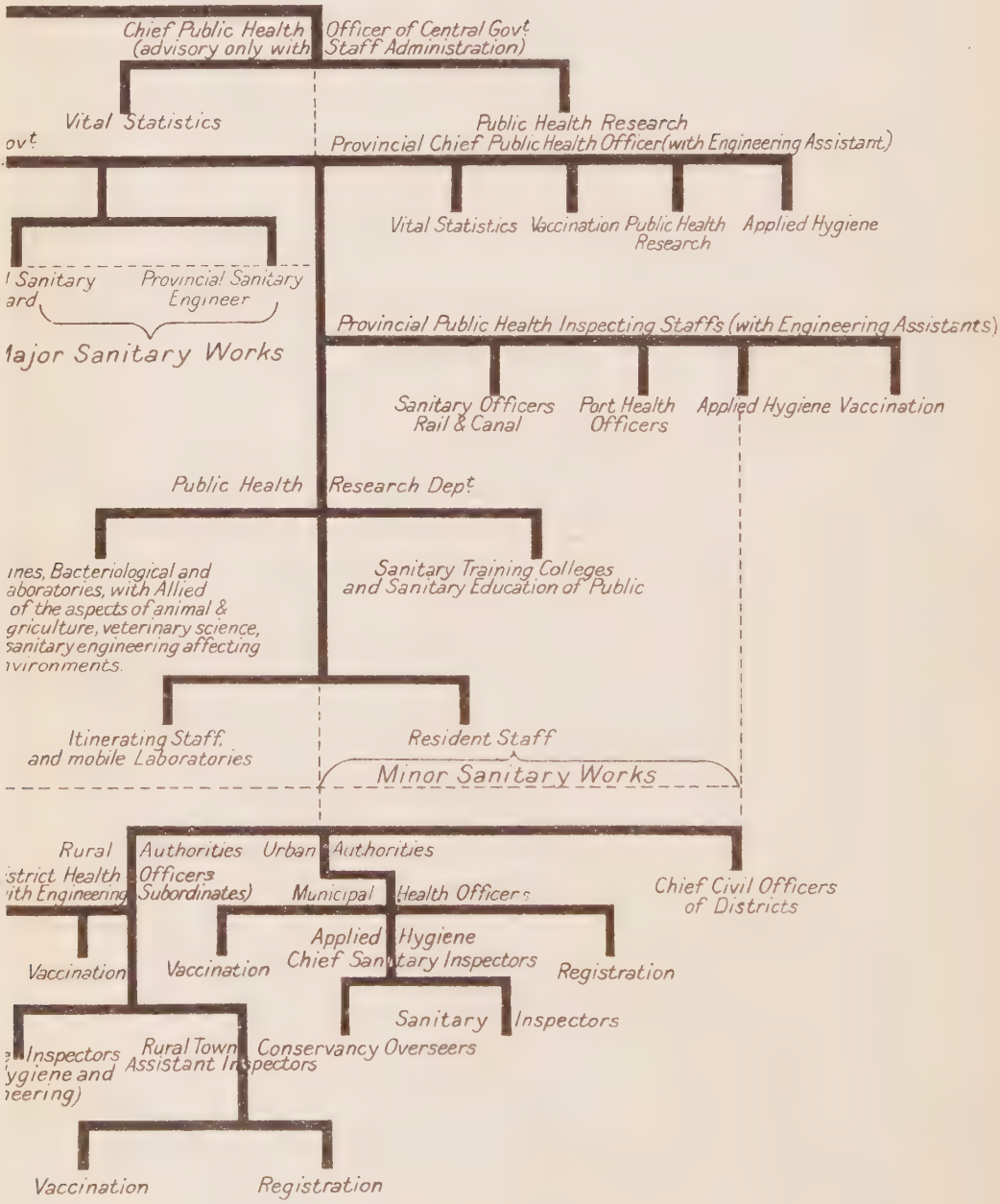

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but would seem the natural outcome of expansion in applied Hygiene in the Tropics, whilst, as remarked above, there are definite signs of the necessity of recognising that the time has arrived for a better defined position of the sanitarian, in conservative Great Britain.

There are, however, points not referred to by these authorities that become of importance in areas of the tropics where administration has sufficiently advanced to require relegation of local matters to elected bodies under self-Government rulings. Such bodies, even in Great Britain, where the principle of self-government is developed so fully, are not absolutely free of a certain amount of discretionary exercise of power by Government officials. Both in the Colonies and in India such precautions would be primarily exercised by the Chief Civil Officers of Districts. Hence, in matters of local importance financially (for instance, as to major works, or touching legal or political interests) the chief Civil Officer of the District concerned is a factor that in sanitary advance cannot be neglected—notwithstanding that these elected local bodies may have powers in deciding upon their course of action. Again, these bodies may pay from their own funds Sanitary Executive, Conservancy and Vaccination Staffs. The officers of the Government Sanitary Department may consider the work of certain members of these staffs inefficient, and may advise removal or other measures ; but in this, as in all other matters, they issue no orders—they advise.

Similarly, if of the Public Health Department of the Central Government there is to be a Medical and Sanitary Branch, there must be the ability to secure professional inter-communication without subordination on either side. Thus, in the interests of Sanitary Research, it may be necessary to obtain data, or other aid, from the Medical Branch. In this there would be no more and should be (having regard to the professional spirit of medical men) less difficulty than in intercommunication with local authorities in other departments of government.

Such matters are illustrated by the accompanying diagram showing a type organisation scheme in the tropics. This is in accord with the main principles* as approved by a Resolution by the Tropical Section of the meeting of the British Medical Association in July last, in connection with a paper read for the writer.

It will be seen that there can exist no difficulty in so linking the Medical and Sanitary Branch of the Public Health Service, Local authorities and Civil Government officials that, whilst the limits of subordination remain clearly defined, the influence of both Departments on public health is in no way trammelled.

The idea of a "Ministry of Euthenics and Economics" is exceedingly elastic ; so that the term is as applicable in the case of a small Administration as in that of a Government controlling an Empire. It implies that Hygiene should take its place as the great exponent of all matters connected with the well-being of man. It does not follow that every Government or Administration could be, at one period of its existence, in possession of all the Departments of Science, which such grouping implies. Nevertheless, if the aim were held steadily in view, there would be evolved, for purposes of Local

* The original diagram was not forthcoming after the meeting.

Governments, as the Departments concerned came into being, such a Ministry—as distinct from the organisations which undertake the financial, judicial, political, and administrative functions of Governments. Under such arrangements the Departments of Agriculture and Mycology, Irrigation, Forests, Veterinary Science, Industries and Commerce, Pisciculture, Geology, Education, Entomology, Agricultural and National Insurance would be brought into natural relation and easy communication with the Department of Public Health and each other.

A Bureau of Public Health.

About the desirability of increasing the facilities for education of the public in sanitary matters, there can be no division of opinion. As shown in the recent Chadwick Lectures by Sir Ronald Ross, however, there exists no reason why the sanitarian should be subordinated to the pedagogue. Consequently, the growing interest of the public in sanitary matters is being met by various expedients. For example, at the present time, the Sanitary Commissioner for Madras (Major Justice, I.M.S.) has, at the request of the Madras Government, prepared a series of lectures suitable for popular audiences, which will be liberally illustrated by topical lantern views illustrating sanitary defects and their method of remedy. These will be delivered by several lecturers simultaneously throughout the country. An important point in the programme is that lay members of self-government bodies will be thus reached.

To systematise this method of education, Surgeon-General Bannerman, C.S.I., in an able lecture before the Indian Science Congress at Madras in January of this year, after advocating the necessity of not only encouraging research but giving research workers a living wage, made a special plea for the establishment of a Bureau of Public Health. He stated :

"But we not only require research workers, we want an organisation that will help to educate the people in the ordinary rules of health. There should be in each Presidency an official whose business it is to look after the hygienic education of the common people. He should be in charge of a Bureau of Public Health, and his work should consist in preparing pamphlets and popular lectures with lantern slide illustrations which could be lent to lecturers who would undertake to itinerate in the villages and talk to the common people. He should organise classes for the teachers in our Teachers' Colleges and he should gather together and popularise information from every quarter."

SANITARY RULINGS.

Alcohol.

The "what is whiskey?" cry which accompanied a few years back the question of what is "pot" and what "still" spirit, is likely to be complicated by the scientific tradesman rendering spirit which has been denatured sufficiently physically fit to pass as wholesome. The Government of Madras have found it necessary to make a special enactment on the matter (Madras Act, No. 1 of 1915) as follows :—

"The following shall be substituted for section 55-A :—

"Whoever renders or attempts to render fit for human consumption any spirit, whether manufactured in British India or not, which has been denatured, or has in his possession any spirit in respect of which he knows or has reason to believe that any such attempt has been made, shall on conviction before a Magistrate be liable to imprisonment for a term which may extend to three months or to fine which may extend to one thousand rupees or both. For the purpose of this section it shall be presumed unless and until the contrary is proved that any spirit which is proved on chemical analysis to contain any quantity of any of the prescribed denaturants is or contains or has been derived from denatured spirit."

* * * * *

"In section 3 of the said Act the following amendment shall be made :—

"For the existing explanation of the term "denatured" occurring at the end of sub-section (8) the following shall be substituted :—

"*Explanation.*—'Denatured' means subjected to a process prescribed by the Local Government by notification for the purpose of rendering unfit for human consumption."

Anti-Mosquito Measures.

Egypt* possesses a ruling as to anti-mosquito measures which has the merit of being optimistic, if not uncommon. Relying upon the determination of citizens to get rid of mosquitoes and therefore upon willingness to pay for their abolition, the destruction of larvae is effected by the Inspectorate, a fee being charged by the Department for each house dealt with. There is also a provision in the ruling that the amounts collected shall pass to "the general revenue of the State, the cost of the measures being borne by the prophylactic fund. The extent of the operation is therefore at present necessarily limited to the amount of this fund which can be spared for the purpose, the increased fees which would be derived from a more extended application of the measures not being available for such extension." The general result of the ruling is to limit action to scattered houses and as "the mosquito, though not a great traveller, is unfortunately not sufficiently domesticated to confine her attention to the immediate locality in which she is bred," the results of anti-mosquito measures are described as not attended with "marked success."

By-Laws for Water-Works.

The following by-laws have been suggested by the Sanitary Engineer, (Mr. Hutton) to the Government of Madras (G. O. No. 139 M, 1st February, 1915) :—

"Every application for the supply of water under sub-sections (1) and (2) of section 147 shall be made to the Chairman in writing, signed by the applicant and so far as may be in form A hereunto annexed ; and the work

*Annual Report for 1913, Dept. of Public Health, p. 69.

necessary for such supply shall not be commenced until the applicant has deposited the estimated cost of carrying it out with the Municipal Chairman. The estimate will be fixed by the Chairman and if he thinks fit he may prescribe a time within which the deposit shall be made.

"2. Each house to which water is laid on shall be provided with a separate service pipe connection and a stop-cock and meter. No house will be supplied with water from the service connection of any adjoining house or premises.

"3. The diameter and the character of the service and communication pipes, and the number, size and kind of stop-cocks or taps shall in all cases be determined by the Chairman.

"4. *The permissible free allowance under sub-section 1 of section 147 shall be as follows :—

Houses of the rental value per annum of				Daily allowance in gallons.
Below Rs.	30	..	..	30
Above Rs.	30	up to Rs.	50	50
,,	50	,,	100	80
,,	100	,,	150	100
,,	150	,,	200	120
,,	200	,,	250	140
,,	250	,,	300	160
,,	300	,,	350	180
,,	350	,,	400	200
,,	400	,,	700	220
,,	700	,,	1,000	250
,,	1,000	,,	1,500	300
,,	1,500	,,	2,000	350
,,	2,000	,,	2,500	400
,,	2,500	,,	3,000	450
,,	3,000	..	..	500

NOTE.—The allowances of the first three items refer to existing house-connections—*vide* by-law 5 below.

"5. *There shall be no house-connections in the future for houses whose annual rental value is below Rs. 100.

"6. *The charge for excess water shall be regulated at the rate of As. 12 per 1,000 gallons of excess water consumed over free allowance as per scale in the preceding by-law in the case of domestic supplies and Rs. 2 per 1,000 gallons for supplies for non-domestic purposes.

"7. The Municipal Chairman† may, by general or special order, direct that any private latrine, privy, urinal, or water-closet which is supplied with water from municipal water-works shall be provided with a cistern of such size and description as it may prescribe.

"8. Every boiler for generating steam which requires water from a municipal source shall be supplied with water from a cistern and not directly from the service pipe, and every such cistern shall be supplied with a ball-valve, a detective or warning pipe and proper means of access for inspection thereof.

"9. The Chairman may at any time remove any fitting connected with the water-works for the purpose of examining its condition or for repair.

"10. No person shall wilfully or negligently allow the water from a standpost or public water tap to run to waste.

"11. No person shall use the water from the standposts or public water-taps for the washing of clothes, animals or vehicles or for bathing purposes.

"12. No person shall, without the express permission in writing of the Municipal Chairman, use water derived from the standposts or public water-taps or fire-plugs for any building, gardening or agricultural operations or for the purpose of any manufactory.

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* Not yet sanctioned by Madras Government; under consideration.

† The writer considers the word "may" would suitably be substituted by the word "shall," in so evident a sanitary provision.

"13. No person shall so manipulate the standposts, or public water-taps, or fire-plugs as to secure a continuous flow of water for any purpose except for the extinction of fire.

"14. Except in the case of fire, no person not duly authorised by the Municipal Chairman in that behalf shall, within municipal limits, open or in any way interfere with any main or pipe or valve or fire-plug connected with the municipal water-supply."

Specification Report issued by the Madras Sanitary Board (No. 174-S., dated 4th March, 1914) for a House Connection with $\frac{3}{4}$-inch Water Meter.

"*General.*—The house connection shall consist of (1) a length $\frac{3}{4}$-inch galvanised wrought iron service pipe and connections complete, (2) a masonry chamber to locate the stop cock and meter and measuring 3′ 6″ × 3′ with a wrought iron cover plate and (3) a $\frac{3}{4}$-inch water meter with all accessories complete. The dispositions of the pipe, stop cock, meter and pit shall be as shown in the design.

"2. *Service pipe.*—This shall be $\frac{3}{4}$-inch size. The main in the street shall be tapped and a straight ferrule inserted and connected with couplings and back nuts to a suitable length of $\frac{3}{4}$-inch galvanized wrought iron pipe, on which the stop cock and meter shall be fixed, as it crosses the pit. The piping shall then be continued till it reaches the house, crossing the roadside drain on its way as shown in the type design.

"3. *Meter-pit.*—This shall measure 2′ × 1′ 6″ inside and shall be located six inches from the outer edge of the roadside drain towards the centre of the road. The excavation for the pit shall be one foot four inches deep, of which the first six inches shall be filled in with concrete, broken brick in chunam and the remainder shall be built with brick in chunam 9 inches thick. A cutstone coping 9 inches broad and 4 inches deep shall be built over this brick masonry. A suitable slope at the outer edge and a recess all round the inner edge to receive a cover shall be formed on the top of the coping. The interior of the pit including floor shall be plastered with best Portland cement mortar (2 to 1) half an inch thick. There shall be a wrought iron cover plate with necessary locking arrangement as shown in the design.

"4. *Meter.*—This shall be Tylor's patent $\frac{3}{4}$-inch rotary water meter, or other approved type, and shall include strainer, unions for $\frac{3}{4}$-inch galvanized wrought iron tubing with necessary bolts, nuts, washers, etc., complete, similar to illustration on page 243 of Messrs. Tylor & Son's catalogue, 18th edition."

TREATMENT OF WASTE.

Collection of Excreta.

Where it is desired to abolish the "salga" or "choo" in favour of night soil conservancy of any description, in deciding means for collection and transport the question of bulk and weight of excreta necessarily arises. The data for dealing with a population on mixed diet such as that used by Europeans are, of course, well known, and calculations from these, allowing for the increased bulk of the excreta of a population living chiefly on vegetarian diet, can readily be made. But as to what is the bulk that must be allowed for there is some difference of opinion. Edmund Parkes laid down that the Hindu, as a typical vegetarian, passed from 12 to 14 oz. of faeces daily. Urine may be accepted as at 40 oz. per day.

Assuming that the smaller amount (12 ounces) of faeces is the rate per head per day, in calculation for an average population of mixed ages and sex 30 to 35 per cent. should be deducted. At 30 per cent. deduction, the average product of a mixed adult population will amount to 8·4 ounces per day or ·00998 c. ft. per head. Therefore for 1,000 of a mixed population there will be 9·98 c. ft. of faeces and, allowing 40 ounces per day of urine, there will be ·04000 c. ft. per head, or per 1,000, 40 c. ft. Hence, the urine and faeces of a mixed vegetarian population may be calculated at 49·98 per 1,000.*

Approximately, therefore, a mixed vegetarian population would yield 10 c. ft. of faeces only, and 50 c. ft. of combined liquid and solid excreta for 24 hours, per 1,000.

From the above data can be reckoned the number of buckets, or other receptacles of which the cubic capacity is known, required for any number of men using latrines, if there be allowed for each man for defecation five minutes. Galvanised iron pails, such as are largely used for conservancy, differ in size but the commonly available pail in the market is of 3 gallons capacity. To remove a filled bucket and replace it by a clean one, would take about two minutes.

In estimating the numbers who will resort to public latrines, provision need not be made for the total in the area conserved, it being evident that infants, the sick, the permanently infirm and, where a race system of withdrawal of females from the public gaze exists, females may be deducted. This deduction must differ greatly with localities; but it is probable that a fair average would be 20·5 per cent. But the great difficulty in fixing the number of latrines, and seats in these, is with reference to the fact that their use cannot reasonably be distributed over, say, an eight-hour labour day. An estimate which is by no means liberal would be that whilst a certain amount of resort to latrines will occur towards the evening (with Hindus, for example,

*In 1906 Captain A. W. Greig, I.M.S., conducted, at my request, in Mandalay Jail, of which he was Superintendent, careful experiments (verified by repetition) with the object of ascertaining the difference, if any, between these results and those for Burmans. He found the following result:—*Burman male adults per* 1,000: Faeces 18·7 c. ft,; urine 55·856 c. ft., or a total of 74·556 c. ft. Hence, if 35 per cent. be deducted for a mixed population, there results 48·461 c. ft. or if 30 per cent. 52·190.

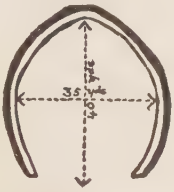
a twice daily resort being frequent) sufficient space must be available for a labouring population within three hours of daylight. If both urine and faeces be received in one bucket, with the data above given it will be found that 795 persons of a population of 1,000 will require 83 buckets to be used in three hours. In any system which will dispose of the urine separately, however, the faeces could, in the same time, be received in 24 buckets.

Disposal of Sullage.

In his paper read before the Institution of Civil Engineers, to which reference is made under the heading of "Malaria" in this number, Mr. Evans showed that, where subsoil drainage was close to labour lines, it could be utilized for sullage water disposal and thus economy be secured. In this he followed the well-known method of sub-surface disposal which is of utility in readily permeable soils. The masonry sump into which the sullage is led for entrance to the subsoil system, he fills with gravel, thus securing a "roughing filter," and therefore greatly aiding the efficiency of this method of disposal by prevention of choking.

The Incineration of Rubbish.

In dry weather in the tropics, in localities sufficiently distant from habitations, disposal of rubbish by incineration in the open may frequently be practised with advantage. The following method*, which was recommended by General Gaselee in a Departmental Order some years back, seems to the writer both simple and efficient :—



"In a convenient place an earthern parapet, shaped like a horse-shoe, is thrown up two feet high. The litter is brought in by the entrance, on donkeys, in bags, etc., etc. Sweepers with forks spread it out inside, to dry. Thereafter, it is gradually thrown over the parapet all round, and set fire to *outside*. Practically the fire never goes out. Ashes accumulate, and the outer ring rises, whilst the interior slope also increases. Three sweepers can work a kiln 120 ft. by 105 ft. and this has been found enough for 2,000 animals, and lasts for several months. As the sweepers work all day, it saves labour to use one large kiln, instead of two small ones."

*Method of disposing of litter at Khar Malakhand Force.

SANITARY WORKS.

Subsoil Drainage.

The Report of the Malaria Advisory Board, Federated Malay States, for 1913 shows that in Kuala Lumpur from 1907 to 1911 the average malarial death-rate was 9·5 per mille. In 1911, anti-malarial drainage was sufficiently carried out to have influence. In 1912, the rate dropped to 4·2 per mille. The experience of the Advisory Board, gathered from anti-malarial measures in all parts of the Malay States, leads them to lay down rulings (p. 54) with which none but extreme supporters of the "all-quinine" policy are likely to disagree :—

"(*a*) Land drainage and cleaning of drained areas ;
"(*b*) Reduction of breeding in lakes, rivers and other large bodies of water, by removal of weeds and algae from shallow places ;
"(*c*) Removal of bottles, tins, boxes, shells or any other waste articles likely to hold water, and the screening of all tanks, wells or water-containing vessels ;
"(*d*) Periodical use of oil or larvicides on breeding places not otherwise dealt with ;
"(*e*) Efficient upkeep of all anti-malarial works."

They by no means neglect the full distribution of quinine as an adjuvant. They make a definite statement of their experience of its use as follows :—

"The Board took steps to further the distribution of quinine wherever malaria is prevalent, and particularly in places far from hospitals or dispensaries. It was considered that tabloid quinine bihydrochloride was the best form for general distribution, and a large supply was obtained in tubes each containing twenty 4-grain tabloids, with a printed wrapper giving directions for its use in English, Malay and Tamil characters. . . . Very favourable reports have been received of its use, and it seems to be in great demand."

Dr. Malcolm Watson has laid down that in the Malay States by means of surface drainage "in low lying alluvial clay soil with a high ground water" and the cutting of jungle (conjoined with drainage), surrounding inhabited areas, it has been possible to practically extinguish malaria throughout 500 square miles. When, however, he attempted to deal with hill country possessed of numerous ravines, difficulty was experienced, until he excogitated a modification of subsoil drainage. The latter method has bulked largely in the works adopted by the Advisory Board in respect to Kuala Lumpur, as well as the drainage and filling of swamps.

Although the application of subsoil drainage to land is in all respects a simple engineering procedure demanding little but ordinary care, as applied to ravines it really approaches largely an elaborate system of interception drains. This, under the varying circumstances of levels, rocks and soil dealt with, implies a great deal of personal attention to details.

On work of this nature Mr. Evans, the Executive Engineer of the Advisory Board, must have acquired unique experience. In a paper read before the Institute of Civil Engineers, he showed that he relied upon ordinary agricultural tile drains for the prime receiving points. These he considers should not be of less diameter than 4 inches, as he found smaller drains liable to choke. The object held in view was the

rendering dry of the swampy bottom of ravines, during the period when they do not serve for the " run off " of storm water. The writer suggests that this means that notwithstanding the steep gradient of these ravines, at certain points subsoil flow meets with obstruction with the result of causing the underflow or substream to accumulate. Hence, apparently, the variety of methods found necessary in executing the work. At one time subsoil drains, doubtless acting as intercepting drains, were required on both sides of a ravine, at another these would be necessary on one side, or, in the centre, a pipe or open drain would be indicated. These pipes Mr. Evans advises should be laid " at a depth of 3 to 4 feet (or deeper on steep slopes) on a carefully graded trench bottom, and covered with palm leaves or long grass, should palm leaves not be available " and then filled over with earth, or failing earth the more friable surface layers of clay. As usual in such work, gravel covering of joints is employed when available. These unglazed agricultural tile drains were laid open-jointed, and discharged into main drains of from 4 to 8 inches diameter. As in the case of sewerage works, drains were laid from the point of discharge to the higher levels. All pipes were made locally, and, as there was no more expert skill available than in average tropical countries, there is no reason why the example of the Malay Advisory Board should not be largely followed. In any case, machines for making agricultural drains by hand power are cheap. The firing of the pipes should be well within the skill of an average Asiatic potter*. Where the gradient was such as to secure suitable velocity, for prevention of mosquito breeding, open main drains were employed. These were of cement concrete formed in wooden moulds, and were laid with open joints. Mr. Evans claims that this is preferable to using fixed joints and weep-holes, which he considers " often permit mosquitoes to breed in the water in or behind the holes."

Having laid down drains in ravines subject to the velocity of storm water, the question of maintenance is of much moment. In the absence of special precautions, they may well be laid bare by scour and be displaced. Discussing this, Mr. Evans states that where drains pass through " double rock cuttings, small masonry drains or cut-off walls are needed to prevent wash-outs." The best lining for the ravine surface has been proved to be grass " kept close cut, the surface being cut and filled, or caused to fill by silt-deposits to an even slope." If the gradient is more than 1 in 10, the turf is invariably pegged down. He adds that the whole question of the protection of ravine surfaces depends on the quantity of silt carried by flood water ; and the method to be used depends on the condition of the hill sides from which silt may be washed. " The turf banks or drains are often used to cause a drained ravine to silt to an even slope or to arrest silt."

It will be seen that a certain quantity of the silt torn from the hills by the heavy rainfall is duly utilised in levelling portions of the ravines. But it is evident the cost of maintenance would be greatly reduced, if it were possible to decrease the velocity of flow of the storm water in the ravines. The writer suggests that this end might be

*Probably in countries where the rainfall may be less heavy than in certain parts of the Malay States, the use of minor drains of the large diameter of four inches, as found necessary by Mr. Evans, might be dispensed with.

greatly aided by more extensive use of silt than stated by Mr. Evans. It should be possible, at certain points of such ravines, to lead the storm water from them to distant points, where the process of terracing in agriculturist interests, as advised by Sir Edward Buck, could be pursued with advantage. Selection of sites in reference to inhabited areas, and the judicious use of drainage so as to lead back the water free of silt to the ravine, ought to prevent dread of creating mosquito breeding places. It is also conceivable that at certain, possibly rare, points (depth below ground level and nature of subsoil being favourable) instead of following with great labour the sides of a ravine, it would pay to regard it as the main drain of a subsoil drainage system, and to use, in herring-bone pattern, minor agricultural drains extending on both sides at long intervals, so as to intercept the subsoil water and deliver it into a central drain.

Mr. Evans estimates that the total cost of thoroughly draining hill lands in the Malay States will not exceed £4 4*s.* per acre of gross acre drained. In this estimate, he allows for pay of Tamils at 10*d.* and Chinese at 1*s.* 6*d.* per diem. For the first year after completion he would allow for maintenance ten per cent. of the first cost, and five per cent. in subsequent years. In the Kuala Lumpur anti-malarial work, 3,000 acres were drained. Excellent as the results have been, in decreasing the incidence of malarial fevers, the full effect cannot be expected until the filling of a swamp—now in progress by the local Department of Public Works—is completed.

Water-waste Prevention.

In Great Britain, the legal control of companies which possess waterworks and supply water within the areas of public bodies is sufficiently complete to ensure that waste of water is much less likely to occur than in most of our tropical possessions, where waterworks are ordinarily the property of local authorities. When to the very normal tendency to careless waste of water is added the difficulties of privacy enjoined by the caste system found in India, the matter is liable to become of serious public importance, not only in the interests of prevention of pool formation and waterlogging of the soil but as representing useless expenditure of funds which are raised by taxation. The economic aspect of the subject is particularly acute in places where the whole supply is dependent upon pumping, as every gallon raised represents a definite sum expended. Even in gravitation systems, with a public body in charge possessed of a determination to please the ratepayers, the right to waste may be conceded by reckless extension of private services; with the natural sequel that pressure falls at certain points and general grumbling as to inefficiency of the water works and of the whilom popular authorities is brought about. Moreover, once a haphazard method of governing a water supply is introduced great difficulty will be found in securing reform. The members of local bodies are themselves householders, and it becomes difficult for certain of them to realise that when they have for years been allowed to use as much water as they liked, they should suddenly be subjected in their private capacities to discipline in the public interests. Hence, it is apparent that, to prevent disease and unnecessary taxation, methods of control of waste in public water

supplies should be excogitated, and be capable of legal enforcement—not after some years' experience of how *not* to manage waterworks has forced the necessity for action upon a public authority, but as a part of the scheme on introduction.

In the Madras Presidency, the District Municipalities Act confers the power of regulation of water supply upon municipal councils, and although frequently the subject of advice by both Sanitary and Sanitary Engineering Officers, the methods followed in various localities have, in course of time, become so varied that the Madras Government has thought it advisable to secure the adoption of by-laws that will afford more uniform methods. The Sanitary Engineer to the Madras Government, Mr. W. HUTTON, has accordingly submitted draft rulings (G. O. No. 139 M, 1st Feb., 1915) which have in the main the approval of the Madras Government. Certain of these are reproduced under "Sanitary Rulings" in this number.

The principles, as finally approved by the Madras Government, include the right of a Municipal Council to refuse a new house connection in future unless a meter is attached to it. From this ruling, it follows, according to the Madras Government, that "it is necessary to prescribe a minimum limit to the size of houses which should be granted house connection even with meters." This principle is doubtless correct; but the Sanitary Engineer expands it by advising the classification of houses founded on their rental values, so as to permit certain amounts of "free water" without charge, above which an amount payable by meter measurement would be enforced. This suggestion of the Sanitary Engineer is not at present sanctioned, as the existing laws will not cover it, but the Government promise consideration of amendments to this end. The amount the householder will pay in various towns is not to be fixed by the Councils with regard to actual cost (which would be greater in towns supplied by pumping than by gravitation systems) but the standard rate of 12 annas per 1,000 gallons is laid down.

All connections are required to be according to type designs prescribed by the Sanitary Board, and a definite ruling is laid down that no new house connection is to be made with any main or branch "in which the average pressure is less than ten feet above ground level during the hours of maximum demand." A further useful decision is as follows :—

"As regards additional street fountains on existing mains, the Government agree with Mr. Hutton that the larger the number of street fountains the less will be the demand for house-connections and consequently the less the probability of wastage of water. Municipal councils will accordingly be permitted to sanction estimates for erecting such fountains, provided that they are in accordance with type designs 113-A and 113-B issued with Sanitary Board's Proceedings No. 374-S, dated 19th October, 1911, but no fountain should be erected on new pipe lines, nor on existing lines specially extended for the purpose, without the approval of the Sanitary Engineer or the Deputy Sanitary Engineer in charge of the circle, even when the estimated cost is below Rs. 500. It is necessary to prescribe this restriction because it has been found in practice that councils acting without expert advice have not infrequently spoiled their distribution systems and the water by putting in pipes of wrong sizes or by allowing dead-ends without scour valves."

Whilst the above rulings are made applicable to the 25 District Municipalities in possession of public water supplies, the method

sanctioned in Madras City is somewhat different. Writing in the "Indian and Eastern Engineer" (Calcutta) April, 1915, Mr. MADELEY, M.I.C.E., the special Engineer for the Madras Corporation, describes the arrangement adopted in the water works recently remodelled by him :—

"Connections are allowed only to 'pucca' houses that are assessed at or above a value to be settled from time to time by the Standing Committee.

"Each Service starts with a brass ferrule in the water main and is provided with a brass screw down stop cock in the road.

"Lead or iron pipes may be used, but if the latter they must be properly protected from corrosion when laid in earth.

"Two classes of connections have been adopted, namely, 'first class' and 'second class.' The *second class*, which will apply to the bulk of the population, enables a householder to have his own taps, provided they are placed in such positions that they can, at all times, be inspected by the Municipal staff. No second class service will be of larger bore than half an inch. Anyone desirous of having a supply which is not open to inspection without notice may have a *first class service*, which is subject to the following conditions :—

"(1) The householder is required to hire water meters placed at his disposal by the Corporation, to adopt specified fittings, and to secure approval of the position of pipes and taps.

"(2) He obtains a free supply of 160 gallons per month for every rupee of rent with a minimum free allowance of 3,000 gallons per month.

"(3) A charge of 12 annas per 1,000 gallons is made for all water used in excess of the free supply."

The writer thinks the scheme advocated by Mr. MADELEY is more suitable for adoption in a tropical city (especially if containing persons with caste or racial prejudices) than that now arranged for District Municipalities. The concession, however, made for first class service seems far more liberal than necessary, especially when dealing with so limited a supply as 25 gallons per head, on which the Madras City supply (under pressure of economy) was reckoned. Moreover, there is no obvious advantage, putting such consideration aside in the second or third class service, in bringing house rental as a factor into the first class service ruling ; beyond specifying the character of structure and minimum value of a house that will be accepted for a special or "first class" service. For example, according to the system advised for the District Municipalities, if the inhabitants per house be taken at 5 (a sufficiently correct average for the Madras Presidency) a householder paying a rental of Rs. 30 per month would receive only 6 gallons per head free. This may bear some proportion to the tax he pays for water supply but *in seeking for such a proportion all sanitary dictates are discarded.* Whether a householder be rich or poor, he should be encouraged to use water up to the limit that would imply a correct standard of personal and domestic cleanliness, and this limit*, it is presumed, all correctly designed water works afford.

In temperate climates, more water may go for the cleansing of a large house and various utensils than of a small house, but the personal habit factor in persons of the same caste or race in the East will differ very little. However this may be, the man with the Rs. 30 house pays for his fair proportion of the water supply, which is fixed for a town not on the basis of supplying the poor with one amount and the better

*This standard must exist, irrespective of sanitary sufficiency, in relation to locally available sources, and the demands for trade, municipal purposes and unavoidable waste.

class with another, but that the use of a certain amount of water per individual is right and proper. The principle is followed in respect to the second and third class service of the Madras City, by providing in one case a sufficiency of public hydrants and, in the other, by allowing to any person desirous a personal supply on his payment of necessary expenses, and on condition that the service tap is so placed that it should be open to inspection at all hours by the inspecting staff.* These two services secure all that is required in the public interest, in that waste is effectually prevented by their being open to inspection, and the individual served (so long as waste is not proved) may use all the water that can get through (say, in a Madras City second class service) a half-inch pipe in 24 hours. Rightly a person who requires not merely to use the supply judged to be necessary for sanitary requirements but to employ water as a luxury and, as an accompaniment of that luxury, demands its use in such privacy that the fact of waste may be concealed should, in the public interest, be made to show actual consumption, beyond the average he is entitled to in common with all the payers, by the use of a meter. But the writer fails to see that the average per head supply should be exceeded in favour of the richer members of a community as suggested in the by-laws (para. 4) shown under Sanitary Rulings. It might be said in defence of such a system that the house which pays the greater tax does so because it possesses much space, and therefore would ordinarily contain the greater number of human beings. But both these arguments are fallacious ; the tax is proportionate for all, and large families are not the prerogative of the rich.

Failing the troublesome adjustment by actual enquiry of a house population in each case, the writer considers that the only just and sanitarily safe procedure is to hold that a house contains the average number of inhabitants as proved by the Census for the town in question and, where a "first class" supply is given, to allow free of charge the standard supply for domestic purposes of this particular waterworks, multiplied by the average inhabitants ; beyond that all water, as found by meter measurement, should be charged for. There would then be for each town a standard free allowance per house of whatever rental.

Town Planning.

At the Conference of the Victoria League at the Imperial Health Conference, London, Mr. Raymond Unwin read a paper an extract from which is selected for special notice by "Indian Engineering" (Calcutta) of February 13, 1915, in an article on town planning. This treats of an aspect of the ownership of land in regard to town improvements which is frequently lost sight of, and should be of interest to those engaged in development of our Colonies in the tropics :—

"The first instance we will take from an English town, assuming land worth, undeveloped, £500 per acre. It will be seen that with 340 houses to the area of 10 acres, each plot would contain 83½ square yards ; the cost would be represented by a ground rent of 8*d*. per week and the price

*This would ordinarily imply the placing of a tap in a verandah facing the public thoroughfare, guarded by a wire gauze box of which the householder would have the key, and thus prevent handling by outsiders.

of the land per square yard would be 10*s.* 4½*d.* If the number of houses is reduced to 152, the size of the average plot will be increased to 261½ square yards, more than three times the former area, the equivalent ground rent will only go up to 11¾*d.*, while the price per square yard will drop to 4*s.* 9¼*d.* Here it will be seen that without any change in the original land value, it is possible, economically, to have the use of 261 yards of land for 11¾*d.* per week instead of having only 83 yards of land for 8d. per week. Surely in buying no other commodity are we so foolish as in the purchase of land! I am quite sure that it would be very difficult for any of us to persuade a child of seven to give 8*d.* at one shop for 83 marbles, if at another he could buy 261 for 11¾*d.* It seems therefore that this overcrowding is somewhat foolish from the tenant's point of view; let us look at it from the landowner's point of view. The particular town to which these figures as to cost of land and roads refer is adding to its population 17,000 people each year; with an average of five persons per house this means that 3,400 houses are required each year. Assuming that the whole of the development takes place at present on the basis of 34 houses to the acre, the landowners around that town will be selling 100 acres each year of building land. If we assume that the value of that land for agricultural purposes is £50 per acre, the total increment from this 100 acres sold at £500 per acre would be £45,000. If a town-planning scheme were to limit the number of houses to the acre to 15, as in our second example, to house the same number of people would require 227 acres; if these were sold at the same price, and we have seen that the tenants would be getting cheaper land even so, the total increment after deducting the value of the agricultural land would amount to £102,150. So that, in this particular instance the folly of the landowners in allowing their land to be overcrowded would seem to be depriving them of £57,150 per annum of increment value. If, instead of asking the same price per acre for the raw land, the owners as a class were to be content with the same total increment value from the conversion of agricultural land into building land due to the growing population each year, they would, under the new system, be able to sell their land at £250 per acre, and yet be as well off as they were under the overcrowded conditions, while the effect of this reduction in the cost would be to give to the tenant his plot of 261 yards of land for 8½*d.* per week in place of his 83 yards for 8*d.*, or to enable him to buy it for 3*s.* 6*d.* per yard instead of having to pay 10*s.* 4½*d.* per yard. But this is not an extreme instance."

VITAL STATISTICS.

The Fallacy of the Total Death-Rate of Towns.

Vital statistics should afford a test of the influence of applied hygiene on populations and, perhaps, in no way could the lesson they teach be more forcible than in contrasting the length of life of various sections of a people living on practically the same soil under similar climatic conditions. This method is pursued by Dr. Crake, Health Officer, Calcutta, in his Annual Report for 1913. He shows that in Wards inhabited by soldiers, or officials who have the opportunity when sick of being sent to swell the mortality of England, or, again, where in business portions of the City young males predominate, the Annual death-rates vary from 6·4, 11·5 to 13·3 per mille. He however sums up consideration of these particular populations by stating: "Making every allowance for the abnormal constitution of the population of these wards, however, there can be no question that their superior sanitary condition plays a very important part in reducing the mortality rates. I am quite sure that if their respective populations were moved *en masse* to the more insanitary quarters of the City, nothing like these rates would be recorded." Having eliminated these exceptional areas, he makes the following contrasts:—

Wards.	*Mortality per mille.*
Kidderpore	42·6
Entally	33·2
Beemapooker	35·9
Puddopuker (suburban)	32·2
Ballygunge	32·2

The general death-rate amongst females was 39·4 per mille compared with 24·3 amongst males. In one Ward, the rate for females was 48·2 per mille. In six other Wards the respective rates were 41, 40·6, 45·7, 41·1 and 43·7. Dr. Crake then states:—

"These figures constitute a terrible indictment of the purdah system. Surely, the women of India have a right to demand the abolition of a custom which means premature death to so many of them. Intolerably bad as the housing conditions are in many of the slums of Calcutta, it is only when the inmates are constantly exposed to these insanitary surroundings day and night, that they suffer so severely. Amongst males, who can escape during the day, the rate of mortality is little more than half that amongst females. . . . To secure privacy, efficient lighting and ventilation are absolutely disregarded, the zenana, or women's apartments being usually the most insanitary part of the house. No wonder that tuberculosis, which thrives in damp, dark, airless corners, plays havoc in the zenana."

In the matter of age at death, females in Calcutta again suffer disproportionately, as Dr. Crake states:—"As the rates of 40–50 years and 50–60 years are almost identical for the two sexes, it is clear that the heavy mortality amongst females at child bearing ages is intimately associated with the risks of child birth and with the debilitating effects of prolonged lactation, and the strain, pecuniary as well as physical of bringing up a succession of children."

The total death-rate for Calcutta for 1913 was 29·2 per mille, in itself a heavy rate; but Dr. Crake's dissection by Wards and sex shows how great extremes are concealed by rates which take into consideration only the total population of different constitutions, living under vastly different sanitary conditions.

West Africa.

A graph showing the vital statistics of non-native officials during 1914 has been recently published in a Parliamentary paper [Cd. 1871]. This represents the advance in life-saving between 1903 and 1914, in areas hitherto classed as the "white man's grave." Were it not that 1914 did not close without a call to arms demanding the sacrifice of lives in this as in other parts of the Empire, the perusal of this graph could not fail to have given pleasure to both curative and sanitary branches of the profession. To enable the loss of life in action to be eliminated, the graph for 1914 possesses a double line.

On the 1st January 1914 the non-native officials in the Service in Gambia, Sierra Leone, Gold Coast, and Nigeria numbered, respectively, 44, 216, 611 and 1,728, or a total of 2,641. In 1903, the death-rate was 20·6 and the invaliding rate 65·1 per mille; by 1913, the respective rates had fallen to 11·8 and 42·6. In 1914, the death-rate was, excluding loss in action, 12·7 and the invaliding rate (which does not show a separate calculation for those invalided on account of wounds or illness contracted "in and by the Service") amounted to 36·4 per mille, a decrease from the previous year that bespeaks the determination of each man to stay in the country and "do his bit." Including deaths during military operations, the death-rate for 1914 would amount to 19·3 per mille; but if deaths directly due to operations in the field be excluded, as well as those "in connection with those operations," the actual death-rate would not, in 1914, have exceeded 10·5 per mille.

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van LOGHEM (J. J.). *Bacterium (Proteus) anindologenes.* N. SP.—*Folia Microbiologica*, 1915.

NOC (F.). Hygiène et Prophylaxie. Les dysenteries tropicales et leur traitement spécifique. 1915. Saigon : Imprimerie Albert Portail.

THIBAULT (J. K.). A Comparative Study on the Losses to Rural Industries from Malarial Mosquitoes.—*Southern Med. Jl.*, 1915.

WALKER (E. L.). The Morphology of the Adults of the Filaria found in the Philippine Islands.—*Philippine Jl. Sci.*, 1914.

WALKER (E. L.) & BARBER (M. A.). Malaria in the Philippine Islands. 1. Experiments on the Transmission of Malaria with *Anopheles (Myzomyia) febrifer* Sp. Nov., *Anopheles (Pseudomyzomya) rossii, Anopheles (Myzorhynchus) barbirostris, Anopheles (Myzorhynchus) sinensis*, and *Anopheles (Nyssorhynchus) maculatus.—Philippine Jl. Sci.*, 1914.

Note.—Any of the foregoing reprints or pamphlets will be sent on loan to any part of the world on application, the Bureau paying outward postage.

Books received.

INDEX CATALOGUE of the Library of the Surgeon-General, U.S. Army. Second Series, Vol. 19 (U–Uzielli), 674 pp. 1914. Washington : Govt. Printing Office.

PHILLIPS (Llewellyn Powell) [M.A., M.D., B.C. (Cantab), F.R.C.P. (Lond.), F.R.C.S. (England).] Amoebiasis and the Dysenteries.—xi+147 pp. Demy 8vo. 1915. London : H. K. Lewis, 136, Gower Street, W.C. [Price 6*s.* 6*d.* net.]

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